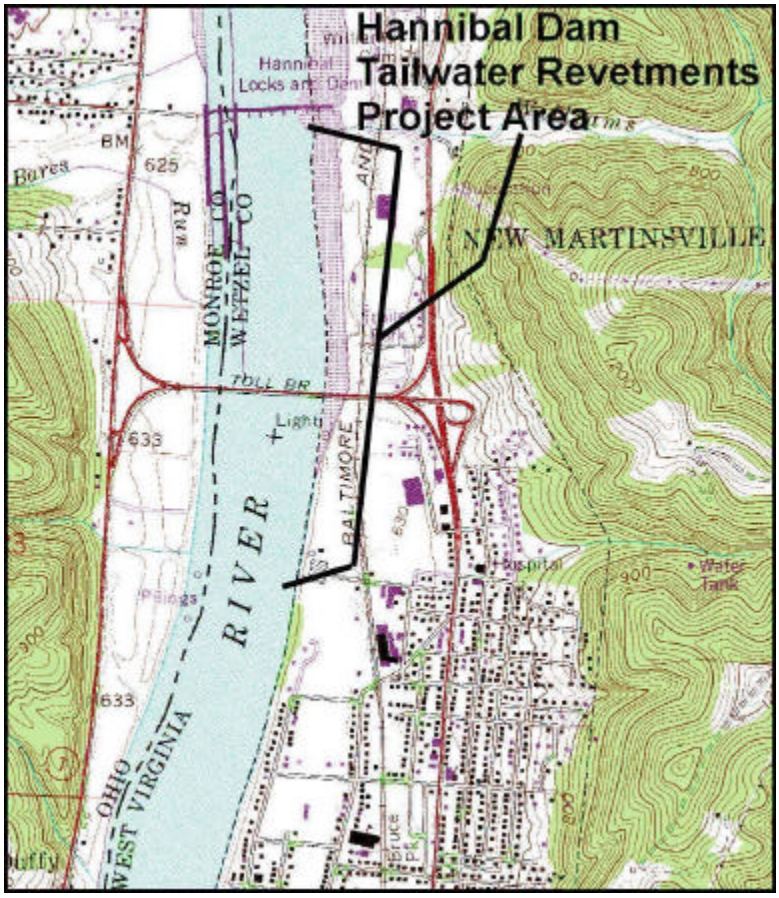
EXHIBIT H-5. EXAMPLE 4. HANNIBAL DAM TAILWATER REVETMENTS, WEST VIRGINIA

EXHIBIT H-5

6.1 HANNIBAL DAM TAILWATER REVETMENTS (WV-40)

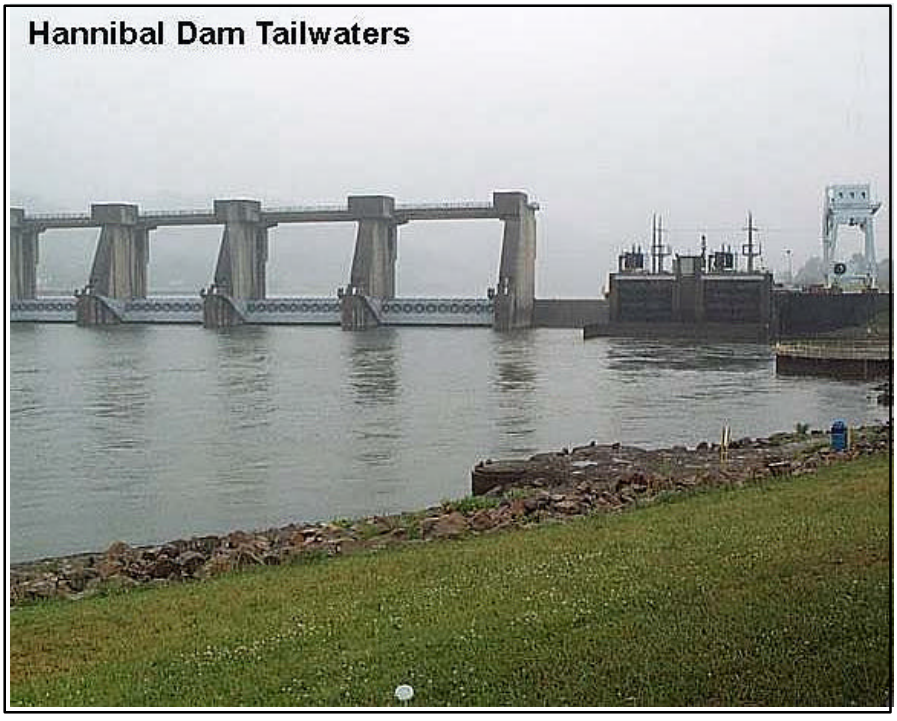
1.0 Location

The proposed Hannibal Dam Tailwater Revetments project area is located in Wetzel County, West Virginia within the City of New Martinsville, West Virginia. The project site is immediately downstream (south) from the Hannibal Locks and Dam in the Ohio River Willow Island Pool between Ohio River Mile (ORM) 126.9 and 128.5. The project site is within the jurisdiction of the Huntington District, U.S. Army Corps of Engineers (USACE).



2.0 Project Goal

The primary goals of the Hannibal Dam Tailwater Revetments project are to provide aquatic habitat diversity downstream from Hannibal Dam, to provide winter velocity shelters for fishes in the Ohio River, and to provide off-shore structure. Altering the heterogeneous habitat downstream from the dam would improve species diversity, facilitate a sustained fishery resource.



3.0 Project Description and Rationale

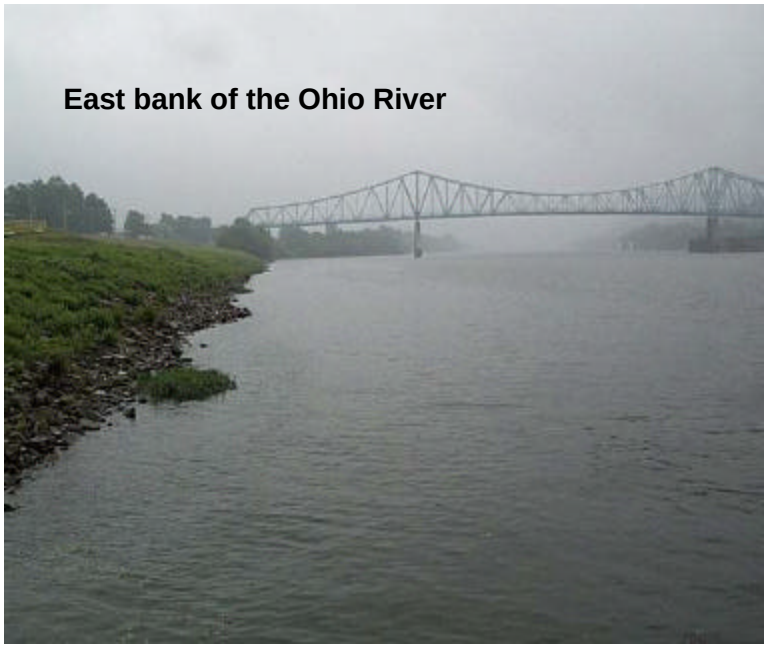
The Hannibal Dam Tailwater Revetments project will consist of three primary elements including:

- Construct two boulder (rip-rap) revetments that runs parallel/adjacent to the east bank of the Ohio River from the handicap fishing pier downstream approximately 600 feet;
- Construct three off-shore revetment(rip-rap) structures near the restricted access buoy line; and
- Dredge the mouth of Williams Run to provide a deep water outlet for the City of New Martinsville stormwater system and enhance bank fishing opportunities.

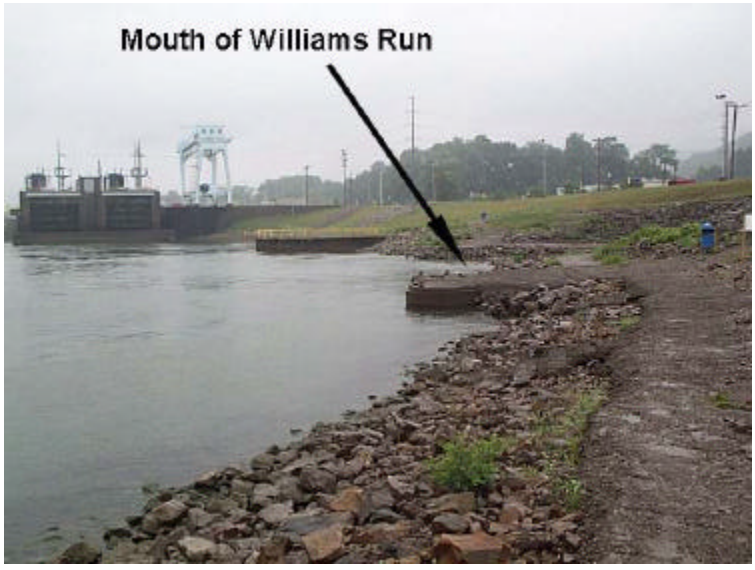
The hard point structures will be constructed at various depths and at various distances from the shoreline to maximize habitat heterogeneity. The off-shore revetments will provide habitat diversity, winter velocity shelters for fishes, and hard structure for bank and boat fishermen.

4.0 Existing Conditions

Terrestrial/Riparian Habitat: The West Virginia bank of the Ohio River south of Hannibal Dam is covered with rip-rap near the waters edge and the higher portions of the riverbank are covered with maintained grasses. Approximately 0.4 miles south of the dam the banks of the river are populated with riparian trees. The dominant species present in the stand include box elder (*Acer negundo*), sycamore (*Platanus occidentalis*), and silver maple (*Acer saccharinum)*. A maintained park lies parallel to the length of the project area, and the entire project area is within the City of New Martinsville.



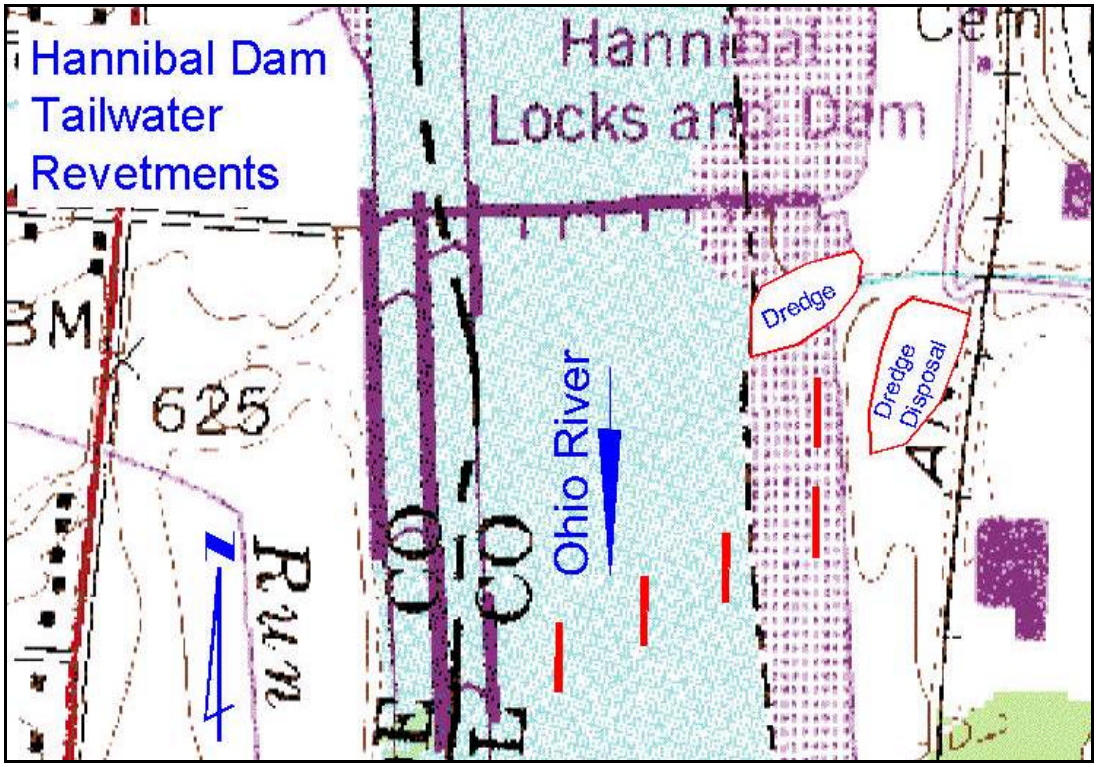
Aquatic Habitats: There is currently minimal bottom structure or habitat diversity in the location where the off-shore revetments would be positioned. The banks are characterized by gravel and rip-rap and the bottom substrates are composed primarily of small gravel and coarse sand. The mouth of Williams Run has become completely filled with silt, coarse sand, and gravel.



Wetlands: There are no jurisdictional wetlands present in the vicinity of the proposed Hannibal Dam Tailwater Revetments project area.

Federally-Listed Threatened and Endangered Species: With the exception of the migratory bald eagle (*Haliaeetus leucocephalus*) and peregrine falcon (*Falco peregrinus*), there are no federally-protected species known to occur within the project area according to the U.S. Fish and Wildlife Service (USFWS, 1999).

5.0 Project Diagram



6.0 Engineering Design and Requirements

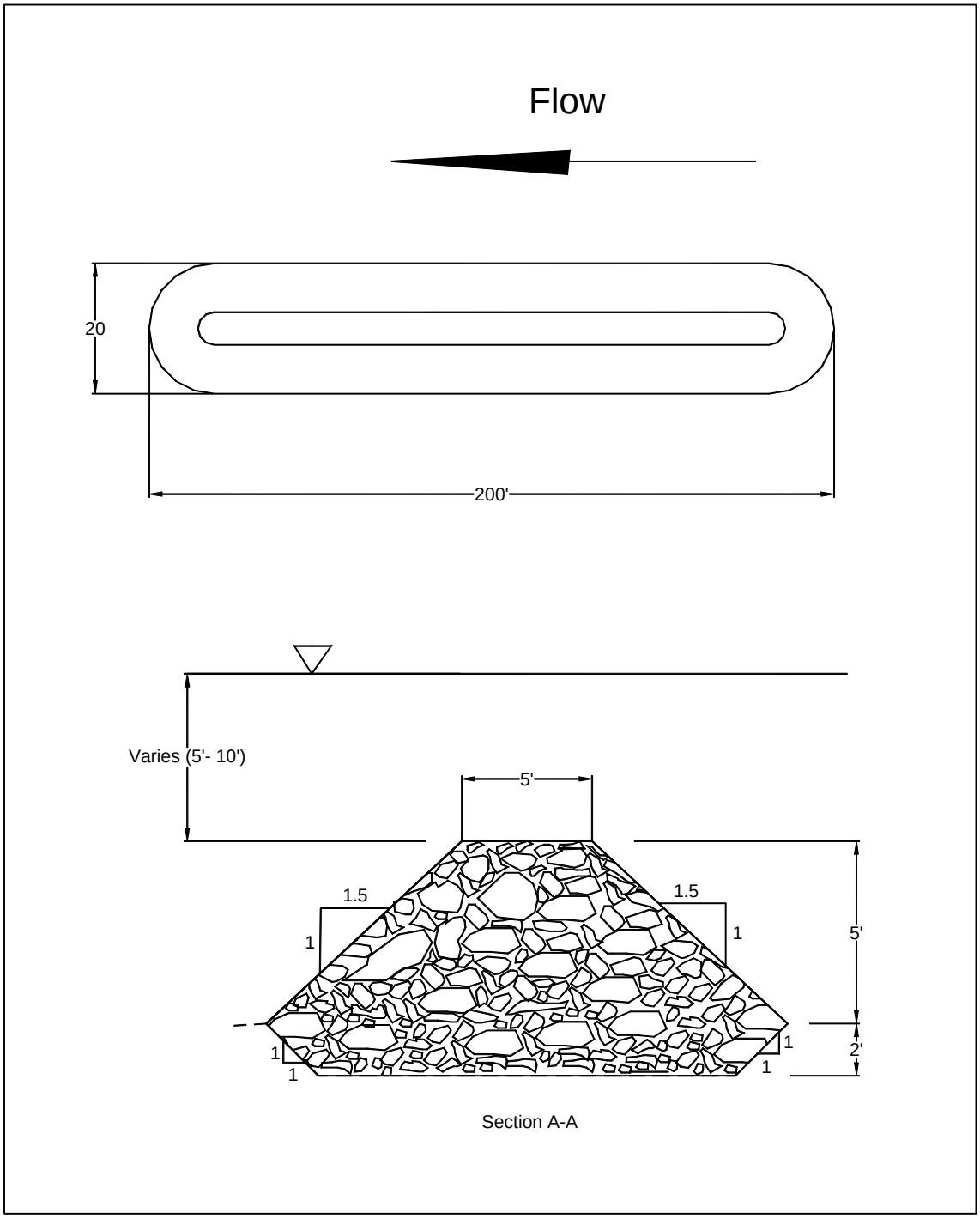
6.1 Existing Ecological/Engineering Concern

The Ohio River channel downstream from the Hannibal Dam has very little habitat diversity, primarily due to the high velocities associated with a tailwater area. Since this area is below the dam, river currents limit the natural deposition of structure, such as snags. The creation of the proposed off-shore revetments would provide a complex structure that would increase submerged habitat. In addition to the added hard substrate, the altered bathymetry associated with changes in water flow would also enhance habitat diversity.

6.2 Off-shore Revetment Structures

An off-shore revetment is a rock (rip-rap) structure designed to provide velocity shelters for aquatic animals, especially fishes. Two of these structures would be placed parallel/adjacent to the east bank of the Ohio River from the handicap fishing pier downstream approximately 600 feet. Three additional off-shore revetments would be placed near the restricted access buoy line. Each of the structures would be 200 feet in length and parallel to the main channel. The side slopes would be 1.5 to 1, and the structure would be toed into the sub-grade a minimum of 2 feet. The size of the rock used shall be uniformly graded limestone with each rock weighing between 50 and 150 pounds. Normally a well-graded rock would be used, however, a uniform gradation would provide better aquatic habitat. The proposed structures are anticipated to function as designed. To ensure that navigation impacts do not occur, these structures should be evaluated by numerical analysis or physical model testing during the preconstruction, engineering, and design (PED) phase of the project.

Figure 1. Off-shore Revetment Detail.



6.3 Embayment Dredging

Maintenance dredging of the mouth of the Williams Run embayment is required to provide a fish refuge area. An estimated 13,140 cubic yards of silty-clay and sand material would be dredged to restore depths of 8 feet in the embayment mouth. A dredge disposal site is adjacent to the embayment. A small geotube levee 190 feet in length, would be constructed at the designated disposal site for dewatering.

Example of a Geotube Levee

7.0 Planning/Engineering Assumptions

Off-shore Revetment Structures

- Average channel velocities are 3 feet per second.
- All rip-rap material would be shipped by barge to the project site. All costs for shipping are included in the material costs.

Dredging

- A small auger head dredge would be used, and the material would be pumped directly to the disposal site.
- Bottom side slopes will be reshaped to a 3:1.
- Dewatered spoil material will be graded, reseeded with a mixture of cool season grasses, and maintained as part of the park.

8.0 Cost Estimate (Construction)

Off-shore Revetments - Engineering costs for the proposed project are contained on Table 1. A detailed MCACES cost estimate for the proposed project is included in Appendix D.

Williams Run Dredging - Engineering costs for the proposed project are contained on Table 1. A detailed MCACES cost estimate for the proposed project is included in Appendix D.

Table 1. Engineering Costs.	
Item	**Cost**
Off-shore Revetments (Total of 5 structures)	$148,200
Dredging	$24,700
Geotube Levee	$3,000
Mobilization & Contingencies @ 20%	$35,300
TOTAL	**$211,200**

9.0 Schedule

Hannibal Dam Tailwater Revetments: The estimated construction time for this project is shown on Table 2.

Table 2. Construction Schedule.	
Item	**Time**
Off-shore Revetments (Total of 5 structures)	36 Days
Dredging	27 Days
Mobilization	6 Days
TOTAL	**69 Days**

10.0 Expected Ecological Benefits

Terrestrial/Riparian Habitat: The Hannibal Dam Tailwater Revetments project would be constructed in-stream adjacent to the Ohio bank of the Ohio River. Since almost all of the proposed construction would be in-stream, there would be no reasonably foreseeable beneficial impacts to terrestrial/riparian resources.

Aquatic Habitats: Long-term beneficial impacts to aquatic resources would be anticipated as a result of constructing the Hannibal Dam Tailwater Revetments. The complex arrangement of the rip-rap structures coupled with localized changes in flow patterns and the scouring effects downstream from the rock revetments would lead to improved habitat diversity for aquatic species. Habitat requirements for fishes change seasonally (Sheaffer, 1986). The rock structures and the changes in bathymetry associated with the altered water flow from the structure would provide velocity shelters during the winter (Scott, 1989 and Sheehan, 1994).

The addition of the hard substrate (rip-rap) would result in long-term beneficial impacts to other aquatic species, especially benthic and epibenthic macroinvertebrates, due to the increase in the habitat diversity. The rip-rap structures would provide more silt-free submerged surface area for invertebrates as well as escape cover for various invertebrates and small fishes.

Wetlands: There would be no reasonably foreseeable beneficial impacts to jurisdictional wetlands as a result of constructing the Hannibal Dam Tailwater Revetments.

Federally-Listed Threatened and Endangered Species: There would be no reasonably foreseeable beneficial impacts to federally listed threatened and endangered species as a result of constructing the Hannibal Dam Tailwater Revetments.

Socioeconomic Resources: There would be short-term and long-term beneficial impacts to socioeconomic resources as a result of implementing the proposed project. The short-term beneficial impacts would be related to costs and local expenditures associated with the construction of the structures and the dredging of Williams Run. Long term benefits are mostly environmental with insignificant economic benefits.

11.0 Potential Adverse Environmental Impacts

Terrestrial/Riparian Habitat: During the site preparation and construction of the revetments, there would be a potential for short-term adverse impacts to terrestrial species from construction-related noise and disturbance. Considering the existing high volume of disturbance from barge traffic along the Ohio River, recreational bank fishing in the area, and vehicle traffic in New Martinsville, it is likely that the increased noise/disturbance impacts would be very minor.

Aquatic Habitats: There would be a potential for short-term adverse affects to aquatic species, especially immobile benthic invertebrates during the construction of the Hannibal Dam Tailwater Revetments. Localized populations of benthic invertebrates could be covered with rip-rap during the construction of the hard point and revetment structures. In addition, sensitive aquatic species immediately downstream from the site could be adversely impacted by degraded water quality associated with displaced sediments, especially during the site preparation/excavation and the dredging of Williams Run. The adverse impacts to aquatic species would be short term, and the overall beneficial impacts of the restoration project would outweigh the adverse impacts.

Wetlands: There would be no adverse affects to jurisdictional wetlands as a result of constructing the Hannibal Dam Tailwater Revetments.

Federally-Listed Threatened and Endangered Species: There would be no adverse affects to federally-listed threatened and endangered species as a result of constructing the Hannibal Dam Tailwater Revetments.

Socioeconomic Resources: There would be no reasonably foreseeable adverse socioeconomic impacts as a result of implementing the proposed project.

12.0 Mitigation

No significant adverse impacts are expected. Minor impacts associated with site preparation/excavation, dredging of Williams Run, and rock (rip-rap) placement may occur during the construction of this project, however, no significant adverse impacts are expected. The use of best management practices and proper construction techniques would minimize adverse water quality impacts.

13.0 Preliminary Operation and Maintenance Costs:

Hannibal Dam Tailwater Revetments Operation and Maintenance costs are summarized on Table 3.

Table 3. Operation and Maintenance Costs (50 Year Life)

Maintenance	Frequency	Costs
Maintenance Dredging for Williams Run	5 years	$63,000
Repair of Rock Structures	10 years	$74,084

14.0 Potential Cost Share Sponsor(s)

- State of West Virginia
- City of New Martinsville

15.0 Expected Life of the Project

It is anticipated that the project would have an intact life expectancy of 50 years.

16.0 Hazardous, Toxic, and Radiological Waste Considerations

Potential impacts of hazardous, toxic, and radiological waste (HTRW) at the site were visually assessed during a site visit and further assessed via a database search of HTRW records in the site area.

Site Inspection Findings. The Ohio River flows from north to south through the project site located immediately downstream of Hannibal Locks and Dam. A park owned by the city of New Martinsville, West Virginia in Wetzel County is east of the project and the Hannibal lock is located to the west. Williams Run joins the Ohio River on the east side of the river immediately south of the Hannibal Locks and Dam.

The following environmental conditions were considered when conducting the June 14, 1999 project area inspection:

- Suspicious/Unusual Odors;
- Discolored Soil;
- Distressed Vegetation;
- Dirt/Debris Mounds;
- Ground Depressions;
- Oil Staining;
- Above Ground Storage Tanks (ASTs);
- Underground Storage Tanks (USTs);
- Landfills/Wastepiles;
- Impoundments/Lagoons;
- Drum/Container Storage;
- Electrical Transformers;
- Standpipes/Vent pipes;
- Surface Water Discharges;
- Power or Pipelines;
- Mining/Logging; and
- Other

Restrooms, fish cleaning stations, electrical powerlines, and a hydropower discharge are in the project area. Although not observed, electric transformers are likely present in the area. None of the other environmental conditions listed above were observed in the project area.

Risk Management Data Search. A search of available environmental records was conducted by Environmental Data Resources, Inc. (EDR). The search complied with ASTM Standard Practice for Environmental Site Assessments, E 1527-97. The search report with maps showing the search area around the project site is presented in Appendix B. The search distance was configured to include the area of the project and a one mile radius buffer zone beyond the central area of the project. In this case, the radius extended about 0.8 miles up-river from the Hannibal Dam to include the town of Hannibal, Ohio and also captured the northern half of the town of New Martinsville, West Virginia south of the project site. It was conservatively assumed that any environmental conditions beyond the project area buffer zone would not impact the project. Databases searched and the distance searched from the project site for each environmental item (e.g., USTs, NPL sites, etc.) are as follows:

Databases	Search Radius (Miles)
NPL: National Priority List	1.00
Delisted NPL: Contaminated sites removed from the NPL.	1.00
RCRIS-TSD: Resource Conservation and Recovery Information System	1.00
SHWS: State Hazardous Waste Sites	1.00

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System	1.00
CERC-NFRAP: Comprehensive Environmental Response, Compensation, and Liability Information System	1.00
CORRACTS: Corrective Action Report	1.00
SWF/LF: Available Disposal for Solid Waste in Illinois- Solid Waste Landfills Subject to State Surcharge	1.00
LUST: Leaking Underground Storage Tank	1.00
UST: Underground Storage Tank	1.00
RAATS: RCRA Administrative Tracking System	1.00
RCRIS-SQG: Resource Conservation and Recovery Information System for Small Quantity Generators	1.00
RCRIS-LQG: Resource Conservation and Recovery Information System for Large Quantity Generators	1.00
HMIRS: Hazardous Materials Reporting System	1.00
PADS: PCB Activity Database System	1.00
ERNS: Emergency Response Notification System	1.00
FINDS: Facility Index System/Facility Identification Initiative program Summary Report	1.00
TRIS: Toxic Chemical Release Inventory System	1.00
NPL Lien: NPL Liens	1.00
TSCA: Toxic Substances Control Act	1.00
MLTS: Material Licensing Tracking System	1.00
ROD: Record of Decision	1.00
CONSENT: Superfund (CERCLA) Consent Decrees	1.00
Coal Gas: Former Manufactured gas (Coal Gas) Sites	1.00
MINES: Mines Master Index File	1.00

HTRW Findings and Conclusions

The HTRW data search area consisted of a one mile radius surrounding the project site. Within this area there were 7 USTs, 3 LUSTs, and 2 RCRA Small Quantity Generators. There were no NPL sites, coal gas sites, or mines within a one mile radius of the project area.

An inspection of the project site and a search of environmental records relevant to the site, have revealed no evidence of recognized environmental conditions in connection with this project site.

17.0 References

References:	
Scott, 1989	Scott, M.T. and L.A. Nielson. 1989. Young fish distribution in backwaters and main-channel borders of the Kanawha River, West Virginia. Journal of Fisheries Biology No. 35 (Supplement A) pp. 21-27.
Sheaffer, 1986	Sheaffer, W.A. and J.G. Nickum. 1986. Backwater areas as nursery habitats for fishes in Pool 13 of the Upper Mississippi River. Hydrobiology No. 136 pp. 131-140.
Sheehan, 1994	Sheehan, R.J., W.M. Lewis, and L.R. Bodensteiner. 1994. Winter habitat requirements and overwintering of riverine fishes. Fisheries Research Laboratory, Southern Illinois University, Carbondale, Illinois. Final Report F-79-R-6.
USFWS, 1999	U.S. Fish and Wildlife Service, July 6, 1999. Federally Listed Endangered and Threatened Species in West Virginia.

APPENDIX A Threatened & Endangered Species

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN WEST VIRGINIA

COMMON NAME	SCIENTIFIC NAME	STATUS	DISTRIBUTION
FISHES			
None			
BIRDS			
Eagle, bald	Haliaeetus leucocephalus	T*	Entire state Nest sites: (1) Mineral, (2) Hampshire, (1) Hancock, (1) Pendleton, (1) Grant and (3) Hardy Counties
Falcon, American peregrine	Falco peregrinus anatum	E**	Entire state Migratory release sites in Grant, Pendleton, and Fayette Counties Nest site: Grant County
MAMMALS			
Bat, Indiana	Myotis sodalis	E	Known hibernacula in Tucker, Pocahontas, Greenbrier, Randolph, Preston, Pendleton, Monroe and Mercer Counties. Critical habitat: Hellhole Cave, Pendleton County - Additional Counties where bats may occupy summer habitat include: Grant, Hardy, Monongalia, Marion, Taylor, Barbour, Upshur, Webster, Nicholas, Fayette, Raleigh, Wyoming, McDowell, Wayne and Cabell
Bat, Virginia big-eared	Corynorhinus [=Plecotus] townsendii virginianus	E	Primarily northeastern counties, especially Pendleton, Tucker and Grant Counties. Critical habitat: Hellhole Cave, Cave Mountain Cave, Hoffman School Cave, and Sinnit Cave in Pendleton Co.; Cave Hollow Cave in Tucker Co.
Bat, gray	Myotis grisescens	E	Hellhole Cave, Pendleton Co.
Cougar, eastern	Felis concolor cougar	E	Entire state, may be extinct
Squirrel, Virginia northern flying	Glaucomys sabrinus fuscus	E	Pocahontas, Tucker, Pendleton, Greenbrier, Webster, and Randolph Counties, within proclamation boundary of Monongahela National Forest
MOLLUSKS			
Snail, flat-spired three-toothed land	Triodopsis platysayoides	T	Monongalia and Preston Counties, mainly in Cooper's Rock State Forest area, both sides of Cheat River Gorge
Mussel, tubercled blossom pearly	Epioblasma [=Dysnomia] torulosa torulosa	E	Kanawha River, Fayette Co., may be extinct
Mussel, pink mucket pearly	Lampsilis abrupta [=orbiculata]	E	Kanawha River, Fayette Co., Ohio River, Cabell, Mason and Wood Counties; Elk River, Kanawha Co.
Mussel, James spiny	Pleurobema [=Canthyria] collina	E	Monroe Co., South Fork of Potts Creek
Mussel, fanshell	Cyprogenia stegaria [=irrorata]	E	Kanawha River, Fayette Co.; Ohio River, Wood Co.
Mussel, clubshell	Pleurobema clava	E	Elk River, Braxton, Kanawha, and Clay Counties, Hackers Creek, Lewis Co.; Meathouse Fork, Doddridge, Co.
Mussel, northern riffleshell	Epioblasma torulosa rangiana	E	Elk River, Kanawha Co.

COMMON NAME	SCIENTIFIC NAME	STATUS	DISTRIBUTION
PLANTS			
Harperella	Ptilimnium nodosum	E	Morgan and Berkeley Counties
Shale barren rock cress	Arabis serotina	E	Greenbrier, Hardy, and Pendleton Counties
Running buffalo clover	Trifolium stoloniferum	E	Fayette, Webster, Tucker, Pocahontas, Barbour and Randolph Counties
Virginia spiraea	Spiraea virginiana	T	Nicholas, Fayette, Mercer, Raleigh, Summers, and Greenbrier Counties
Northeastern bulrush	Scirpus ancistrochaetus	E	Berkeley and Hardy Counties
Small whorled pogonia	Isotria Medeoloides	T	Greenbrier County
AMPHIBIANS			
Cheat Mountain salamander	Plethodon nettingi	T	Pendleton, Pocahontas, Randolph, and Tucker Counties

* Threatened

** Endangered

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL

# of pages ▸ 2

To

From

Dept./Agency

Phone #

Fax #

Fax #

NSN 7540-01-317-7368 5099-101 GENERAL SERVICES ADMINISTRATION

RARE, THREATENED & ENDANGERED SPECIES
SELECTED COUNTIES OF WEST VIRGINIA

NAME	COMMON NAME	RANKINGS	& FEDERAL STATUS	
*** Cabell County				
AMBYSTOMA JEFFERSONIANUM	JEFFERSON SALAMANDER	S3	G5	
AMORPHA FRUTICOSA	FALSE INDIGO-BUSH	S1	G5	
AMPELOPSIS ARBOREA	PEPPERVINE	S1	G5	
ARUNDINARIA GIGANTEA	GIANT CANE	S2	G5	
CAREX TYPHINA	CAT-TAIL SEDGE	S2	G5	
CARPIODES CARPIO	RIVER CARPSUCKER	S2S3	G5	
CARPIODES VELIFER	HIGHFIN CARPSUCKER	S2	G4G5	
CORALLORRHIZA WISTERIANA	SPRING CORALROOT	S2	G5	
CRYPTOBRANCHUS ALLEGANIENSIS	HELLBENDER	S3	G4	
CYPERUS REFRACTUS	REFLEXED FLATSEDGE	S2	G5	
ELLIPTIO CRASSIDENS	ELEPHANT-EAR	S2	G5	
ENEMION BITERNATUM	FALSE RUE-ANEMONE	S1	G5	
EUMECES LATICEPS	BROADHEAD SKINK	S2	G5	
FRAXINUS QUADRANGULATA	BLUE ASH	S1	G5	
FUSCONAIA EBENA	EBONYSHELL	S1	G4G5	
GRAPTEMYS GEOGRAPHICA	COMMON MAP TURTLE	SH	G5	
HIODON TERGISUS	MOONEYE	S1S2	G5	
ICHTHYOMYZON UNICUSPIS	SILVER LAMPREY	S1	G5	
ICTIOBUS NIGER	BLACK BUFFALO	S2	G5	
LAMPSILIS ABRUPTA	PINK MUCKET	S1	G2	LE
LIGUMIA RECTA	BLACK SANDSHELL	S2	G5	
LUDWIGIA LEPTOCARPA	RIVER SEEDBOX	S2	G5	
LYTHRUM ALATUM	WINGED-LOOSESTRIFE	S2	G5	
MACRHYBOPSIS STORERIANA	SILVER CHUB	S3S4	G5	
MEGALONAIAS NERVOSA	WASHBOARD	S1	G5	
MICROTUS OCHROGASTER	PRAIRIE VOLE	S3	G5	
NOTROPIS BLENNIUS	RIVER SHINER	S3	G5	
OBLIQUARIA REFLEXA	THREEHORN WARTYBACK	S3	G5	
OCHROTOMYS NUTTALLI	GOLDEN MOUSE	S2	G5	
PANDION HALIAETUS	OSPREY	S1B	G5	
PERCINA COPELANDI	CHANNEL DARTER	S2S3	G4	
PERCINA SCIERA	DUSKY DARTER	S3	G5	
PERCINA SHUMARDI	RIVER DARTER	S1	G5	
PLATANTHERA PSYCODES	SMALL PURPLE-FRINGE ORCHIS	S1	G5	
PLEUROBEMA CORDATUM	OHIO PIGTOE	S2	G3	
PLEUROBEMA SINTOXIA	ROUND PIGTOE	S2	G4	
QUADRULA METANEVRA	MONKEYFACE	S1	G4	
RANA PIPIENS	NORTHERN LEOPARD FROG	S3	G5	
REITHRODONTOMYS HUMULIS	EASTERN HARVEST MOUSE	S1	G5	
SIDA HERMAPHRODITA	VIRGINIA MALLOW	S2	G2	
TRIADENUM TUBULOSUM	LARGE MARSH ST. JOHN'S-WORT	S2	G4?	
TRILLIUM NIVALE	SNOW TRILLIUM	S2	G4	
TRUNCILLA TRUNCATA	DEERTOE	S1	G5	
UMBRA LIMI	CENTRAL MUDMINNOW	S1	G5	
*** Hancock County				
AMMODRAMUS HENSLOWII	HENSLOW'S SPARROW	S1B	G4	
CAREX ALOPECOIDEA	FOXTAIL SEDGE	SH	G5	
CAREX PELLITA	WOOLY SEDGE	S1	G5	
CARPIODES CARPIO	RIVER CARPSUCKER	S2S3	G5	
CARPIODES VELIFER	HIGHFIN CARPSUCKER	S2	G4G5	
CLINOSTOMUS ELONGATUS	REDSIDE DACE	S1S2	G4	
EQUISETUM SYLVATICUM	WOODLAND HORSETAIL	S1	G5	
ETHEOSTOMA CAMURUM	BLUEBREAST DARTER	S3	G4	
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	S1B,S2N	G4	LT
HIODON ALOSOIDES	GOLDEYE	S3	G5	
HIODON TERGISUS	MOONEYE	S1S2	G5	
ICTIOBUS CYPRINELLUS	BIGMOUTH BUFFALO	S1S2	G5	

MACRHYBOPSIS STORERIANA	SILVER CHUB	S3S4	G5	
NOTROPIS BLENNIUS	RIVER SHINER	S3	G5	
PANDION HALIAETUS	OSPREY	S1B	G5	
PERCINA COPELANDI	CHANNEL DARTER	S2S3	G4	
SALIX DISCOLOR	GLAUCOUS WILLOW	S2	G5	
SYNOSMA SUAVEOLENS	SWEET-SCENTED INDIAN-PLANTAIN	S1	G3G4	
THUJA OCCIDENTALIS	WHITE CEDAR	S2	G5	
ZAPUS HUDSONIUS	MEADOW JUMPING MOUSE	S3	G5	

*** Jackson County

AMORPHA FRUTICOSA	FALSE INDIGO-BUSH	S1	G5	
AMPELOPSIS ARBOREA	PEPPERVINE	S1	G5	
ARABIS SHORTII	SHORT'S ROCK-CRESS	S1S2	G5	
ASCLEPIAS VIRIDIS	GREEN MILKWEED	S1	G4G5	
CARPIODES CARPIO	RIVER CARPSUCKER	S2S3	G5	
CYPROGENIA STEGARIA	FANSHELL	S1	G1	LE
ELLIPTIO CRASSIDENS	ELEPHANT-EAR	S2	G5	
ENEMION BITERNATUM	FALSE RUE-ANEMONE	S1	G5	
EPIOBLASMA TRIQUETRA	SNUFFBOX	S3	G3	
HELIANTHUS MOLLIS	ASHY SUNFLOWER	SH	G4G5	
HETERANTHERA RENIFORMIS	KIDNEYLEAF MUD-PLANTAIN	S1	G5	
HYPERICUM DRUMMONDII	DRUMMOND ST. JOHN'S-WORT	SH	G5	
JUNCUS SCIRPOIDES	SCIRPUS-LIKE RUSH	S2	G5	
LIGUMIA RECTA	BLACK SANDSHELL	S2	G5	
MACRHYBOPSIS STORERIANA	SILVER CHUB	S3S4	G5	
MEGALONAIAS NERVOSA	WASHBOARD	S1	G5	
OBLIQUARIA REFLEXA	THREEHORN WARTYBACK	S3	G5	
PLETHOBASUS CYPHYUS	SHEEPNOSE	S1	G3	
PLEUROBEMA CORDATUM	OHIO PIGTOE	S2	G3	
POTAMILUS OHIENSIS	PINK PAPERSHELL	S1	G5	
QUADRULA METANEVRA	MONKEYFACE	S1	G4	
QUERCUS SHUMARDII	SHUMARD OAK	S1	G5	
RANUNCULUS SCELERATUS	CURSED CROWFOOT	S3S4	G5	
SCIRPUS PURSHIANUS	WEAKSTALK BULRUSH	S3	G4G5	
TOXOLASMA PARVUS	LILLIPUT	S2	G5	
TRUNCILLA DONACIFORMIS	FAWNSFOOT	S1	G5	
TRUNCILLA TRUNCATA	DEERTOE	S1	G5	

*** Marshall County

ARDEA HERODIAS	GREAT BLUE HERON	S2B,S4N	G5	
CARPIODES CARPIO	RIVER CARPSUCKER	S2S3	G5	
CARPIODES VELIFER	HIGHFIN CARPSUCKER	S2	G4G5	
CLINOSTOMUS ELONGATUS	REDSIDE DACE	S1S2	G4	
CRYPTOBRANCHUS ALLEGANIENSIS	HELLBENDER	S3	G4	
HIODON TERGISUS	MOONEYE	S1S2	G5	
MACRHYBOPSIS STORERIANA	SILVER CHUB	S3S4	G5	
OBLIQUARIA REFLEXA	THREEHORN WARTYBACK	S3	G5	
PERCINA COPELANDI	CHANNEL DARTER	S2S3	G4	
PERCINA SHUMARDI	RIVER DARTER	S1	G5	
RANUNCULUS PENSYLVANICUS	BRISTLY CROWFOOT	S1	G5	

*** Mason County

ACRIS CREPITANS BLANCHARDI	BLANCHARD'S CRICKET FROG	SH	G5T5	
AMBYSTOMA TEXANUM	SMALLMOUTH SALAMANDER	S2	G5	
ANODONTA SUBORBICULATA	FLAT FLOATER	S1	G5	
CAREX BROMOIDES	BROME-LIKE SEDGE	S2	G5	
CAREX TYPHINA	CAT-TAIL SEDGE	S2	G5	
CARPIODES CARPIO	RIVER CARPSUCKER	S2S3	G5	
CHAMAESYCE VERMICULATA	WORM SEEDED SPURGE	S1	G5	
ELLIPTIO CRASSIDENS	ELEPHANT-EAR	S2	G5	
ELODEA NUTTALLII	NUTTALL WATERWEED	S2	G5	
FRAXINUS QUADRANGULATA	BLUE ASH	S1	G5	
FUSCONAIA EBENA	EBONYSHELL	S1	G4G5	
GALACTIA VOLUBILIS	DOWNY MILKPEA	S1	G5	

SYNOSMA SUAVEOLENS	SWEET-SCENTED INDIAN-PLANTAIN	S1	G3G4
TRILLIUM FLEXIPES	DROOPING TRILLIUM	S1	G5
TRUNCILLA DONACIFORMIS	FAWNSFOOT	S1	G5
ZAPUS HUDSONIUS	MEADOW JUMPING MOUSE	S3	G5

*** Tyler County

CAREX BUXBAUMII	BROWN BOG SEDGE	S2	G5
CAREX TYPHINA	CAT-TAIL SEDGE	S2	G5
CHONDESTES GRAMMACUS	LARK SPARROW	S1B	G5
CRYPTOBRANCHUS ALLEGANIENSIS	HELLBENDER	S3	G4
ICTIOBUS CYPRINELLUS	BIGMOUTH BUFFALO	S1S2	G5
LAMPETRA APPENDIX	AMERICAN BROOK LAMPREY	S1	G4
LYTHRURUS UMBRATILIS	REDFIN SHINER	S3	G5
OBLIQUARIA REFLEXA	THREEHORN WARTYBACK	S3	G5
PASPALUM PUBIFLORUM	HAIRY-SEED PASPALUM	S2	G5
PHOXINUS ERYTHROGASTER	SOUTHERN REDBELLY DACE	S2S3	G5
POTAMILUS OHIENSIS	PINK PAPERSHELL	S1	G5
PRUNUS ANGUSTIFOLIA	CHICKASAW PLUM	S1	G5
RANA PIPIENS	NORTHERN LEOPARD FROG	S3	G5
TOXOLASMA PARVUS	LILLIPUT	S2	G5

*** Wayne County

AGERATINA AROMATICA VAR AROMATICA	LESSER SNAKEROOT	S1	G4G5T?
AMBYSTOMA TEXANUM	SMALLMOUTH SALAMANDER	S2	G5
ANEIDES AENEUS	GREEN SALAMANDER	S3	G3G4
ARABIS HIRSUTA VAR PYCNOCARPA	HAIRY ROCK-CRESS	S2	G5T5
CAREX MESOCHOREA	MIDLAND SEDGE	SH	G4G5
CAREX TYPHINA	CAT-TAIL SEDGE	S2	G5
CICINDELA FORMOSA GENEROSA	A TIGER BEETLE	S1	G5T5
CORALLORRHIZA WISTERIANA	SPRING CORALROOT	S2	G5
CORYNORHINUS RAFINESQUII	EASTERN BIG-EARED BAT	S1	G3G4
CROTON GLANDULOSUS	NORTHERN CROTON	SH	G5
CRYPTOBRANCHUS ALLEGANIENSIS	HELLBENDER	S3	G4
CYPERUS REFRACTUS	REFLEXED FLATSEDGE	S2	G5
DASISTOMA MACROPHYLLA	MULLEIN FOXGLOVE	SH	G4
EUMECES LATICEPS	BROADHEAD SKINK	S2	G5
GALACTIA VOLUBILIS	DOWNY MILKPEA	S1	G5
HEXALECTRIS SPICATA	CRESTED CORALROOT	S1	G4?
ICHTHYOMYZON UNICUSPIS	SILVER LAMPREY	S1	G5
LYSIMACHIA HYBRIDA	LOWLAND LOOSESTRIFE	S1	G5
LYSIMACHIA QUADRIFLORA	FOUR-FLOWERED LOOSESTRIFE	S1	G5?
MANFREDA VIRGINICA	FALSE ALOE	S1	G5
OENOTHERA PILOSELLA	EVENING-PRIMROSE	S2	G5
PANDION HALIAETUS	OSPREY	S1B	G5
QUERCUS SHUMARDII	SHUMARD OAK	S1	G5
REITHRODONTOMYS HUMULIS	EASTERN HARVEST MOUSE	S1	G5
SCAPHIOPUS HOLBROOKII	EASTERN SPADEFOOT	S1	G5
SILENE ROTUNDIFOLIA	ROUNDLEAF CATCHFLY	S1	G4
SYNANDRA HISPIDULA	GUYANDOTTE BEAUTY	S2	G4
TRIADENUM TUBULOSUM	LARGE MARSH ST. JOHN'S-WORT	S2	G4?
TRICHOMANES BOSCHIANUM	FILMY FERN	S1	G4
VIOLA TRIPARTITA	THREE-PARTED VIOLET	S1	G5
VITIS CINEREA	PIGEON GRAPE	SH	G4G5

*** Wetzel County

CAREX TYPHINA	CAT-TAIL SEDGE	S2	G5
CARPIODES CARPIO	RIVER CARPSUCKER	S2S3	G5
CHAMAESYCE VERMICULATA	WORM SEEDED SPURGE	S1	G5
CYPERUS SQUARROSUS	AWNED CYPERUS	S2	G5
ELYMUS TRACHYCAULUS SSP TRACHYCAULUS	SLENDER WHEATGRASS	S1	G5T5
EQUISETUM SYLVATICUM	WOODLAND HORSETAIL	S1	G5
HEUCHERA ALBA	WHITE-FLOWERED ALUMROOT	S2	G2Q
HIODON ALOSOIDES	GOLDEYE	S3	G5
HIODON TERGISUS	MOONEYE	S1S2	G5

LUDWIGIA LEPTOCARPA	RIVER SEEDBOX	S2	G5	
MACRHYBOPSIS STORERIANA	SILVER CHUB	S3S4	G5	
NOTROPIS BLENNIUS	RIVER SHINER	S3	G5	
OBLIQUARIA REFLEXA	THREEHORN WARTYBACK	S3	G5	
PERCINA COPELANDI	CHANNEL DARTER	S2S3	G4	
POA SALTUENSIS	DROOPING BLUEGRASS	SH	G5	
POTAMILUS OHIENSIS	PINK PAPERSHELL	S1	G5	
RUDBECKIA FULGIDA	ORANGE CONEFLOWER	SH	G5	
SCHIZACHNE PURPURASCENS	FALSE MELIC	S1	G5	
TOXOLASMA PARVUS	LILLIPUT	S2	G5	
TRILLIUM FLEXIPES	DROOPING TRILLIUM	S1	G5	
TRUNCILLA TRUNCATA	DEERTOE	S1	G5	
UNIOMERUS TETRALASMUS	PONDHORN	S1	G4	

*** Wood County

AMBYSTOMA TEXANUM	SMALLMOUTH SALAMANDER	S2	G5	
CARPIODES CARPIO	RIVER CARPSUCKER	S2S3	G5	
CHAMAESYCE VERMICULATA	WORM SEEDED SPURGE	S1	G5	
CYPERUS SQUARROSUS	AWNED CYPERUS	S2	G5	
CYPROGENIA STEGARIA	FANSHELL	S1	G1	LE
ELLIPTIO CRASSIDENS	ELEPHANT-EAR	S2	G5	
ENEMION BITERNATUM	FALSE RUE-ANEMONE	S1	G5	
FUSCONAIA EBENA	EBONYSHELL	S1	G4G5	
ICHTHYOMYZON GREELEYI	MOUNTAIN BROOK LAMPREY	S1	G3	
LAMPSILIS ABRUPTA	PINK MUCKET	S1	G2	LE
LEMNA VALDIVIANA	PALE DUCKWEED	S2	G5	
LIGUMIA RECTA	BLACK SANDSHELL	S2	G5	
LUDWIGIA LEPTOCARPA	RIVER SEEDBOX	S2	G5	
MACRHYBOPSIS STORERIANA	SILVER CHUB	S3S4	G5	
MEGALONAIAS NERVOSA	WASHBOARD	S1	G5	
NUTTALLANTHUS CANADENSIS	OLD-FIELD TOADFLAX	S2	G4G5	
OBLIQUARIA REFLEXA	THREEHORN WARTYBACK	S3	G5	
PANDION HALIAETUS	OSPREY	S1B	G5	
PELTANDRA VIRGINICA	ARROW-ARUM	S1?	G5	
PERCINA SCIERA	DUSKY DARTER	S3	G5	
PLETHOBASUS CYPHYUS	SHEEPNOSE	S1	G3	
PLEUROBEMA CORDATUM	OHIO PIGTOE	S2	G3	
PLEUROBEMA SINTOXIA	ROUND PIGTOE	S2	G4	
POTAMILUS OHIENSIS	PINK PAPERSHELL	S1	G5	
QUADRULA METANEVRA	MONKEYFACE	S1	G4	
QUERCUS SHUMARDII	SHUMARD OAK	S1	G5	
RANUNCULUS SCELERATUS	CURSED CROWFOOT	S3S4	G5	
SAGITTARIA RIGIDA	SESSILE-FRUITED ARROWHEAD	S2	G5	
SCAPHIOPUS HOLBROOKII	EASTERN SPADEFOOT	S1	G5	
TOXOLASMA PARVUS	LILLIPUT	S2	G5	
TRICOPSIS MULTILINEATA	STRIPED WHITELIP	S1	G?	
TRUNCILLA DONACIFORMIS	FAWNSFOOT	S1	G5	
TRUNCILLA TRUNCATA	DEERTOE	S1	G5	
UNIOMERUS TETRALASMUS	PONDHORN	S1	G4	
UTRICULARIA GIBBA	HUMPED BLADDERWORT	S1	G5	

EXPLANATION OF RANKS

GLOBAL RANK

G1	Five or fewer documented occurrences, or very few remaining individuals globally. Extremely rare and critically imperiled.
G2	Six to 20 documented occurrences, or few remaining individuals globally. Very rare and imperiled.
G3	Twenty-one to 100 documented occurrences. Either very rare and local throughout its range or found locally in a restricted range.
G4	Common and apparently secure globally, though it may be rare in parts of its range, especially at the periphery.
G5	Very common and demonstrably secure, though it may be rare in parts of its range, especially at the periphery.
GH	Historical. May be rediscovered.
GX	Believed extirpated. Little likelihood of rediscovery.
T#	Rank of subspecies or variety.

STATE RANK

S1	Five or fewer documented occurrences, or very few remaining individuals within the state. Extremely rare and critically imperiled.
S2	Six to 20 documented occurrences, or few remaining individuals within the state. Very rare and imperiled.
S3	Twenty-one to 100 documented occurrences.
S4	Common and apparently secure with more than 100 occurrences.
S5	Very common and demonstrably secure.
SH	Historical. Species which have not been relocated within the last 20 years. May be rediscovered.
SX	Believed extirpated. Little likelihood of rediscovery.

CHARACTERS RELATED TO RANKING FOR BIRDS

B	Breeding populations
N	Non-breeding populations
E	Exotic
SA	Accidental or casual
SZN	Regular non-breeding migrant

FEDERAL STATUS

LE	Listed as endangered.
LT	Listed as threatened.
PE	Proposed to be listed as endangered.
PT	Proposed to be listed as threatened.
C1	Candidate for listing.

APPENDIX B Hazardous Toxic and Radiological Wastes

The EDR-Radius Map
with GeoCheck®

WV-40, RM 1269, Hannibal DAM
WV-40, RM 1269, Hannibal DAM
New Martinsville, WV 26155

Inquiry Number: 389089.1s

July 08, 1999

Environmental Data Resources, Inc.
an edr company

The Source For Environmental Risk Management Data

3530 Post Road
Southport, Connecticut 06490

Nationwide Customer Service

Telephone: 1-800-352-0050
Fax: 1-800-231-6802
Internet: www.edrnet.com

TABLE OF CONTENTS

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc. (EDR). The report meets the government records search requirements of ASTM Standard Practice for Environmental Site Assessments, E 1527-97. Search distances are per ASTM standard or custom distances requested by the user.

The address of the subject property for which the search was intended is:

WV-40, RM 1269, HANNIBAL DAM
NEW MARTINSVILLE, WV 26155

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the subject property or within the ASTM E 1527-97 search radius around the subject property for the following Databases:

NPL:	National Priority List
Delisted NPL:	NPL Deletions
RCRIS-TSD:	Resource Conservation and Recovery Information System
SHWS:	State Haz. Waste
CERCLIS:	Comprehensive Environmental Response, Compensation, and Liability Information System
CERC-NFRAP:	Comprehensive Environmental Response, Compensation, and Liability Information System
CORRACTS:	Corrective Action Report
SWF/LF:	List of M.S.W. Landfills/Transfer Station Listing
RAATS:	RCRA Administrative Action Tracking System
RCRIS-LQG:	Resource Conservation and Recovery Information System
HMIRS:	Hazardous Materials Information Reporting System
PADS:	PCB Activity Database System
ERNS:	Emergency Response Notification System
TRIS:	Toxic Chemical Release Inventory System
NPL Lien:	NPL Liens
TSCA:	Toxic Substances Control Act
MLTS:	Material Licensing Tracking System
ROD:	ROD
CONSENT:	Superfund (CERCLA) Consent Decrees
Coal Gas:	Former Manufactured gas (Coal Gas) Sites.
MINES:	Mines Master Index File

Unmapped (orphan) sites are not considered in the foregoing analysis.

Search Results:

Search results for the subject property and the search radius, are listed below:

Subject Property:

The subject property was not listed in any of the databases searched by EDR.

EXECUTIVE SUMMARY

Surrounding Properties:

Elevations have been determined from the USGS 1 degree Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. EDR's definition of a site with an elevation equal to the subject property includes a tolerance of -10 feet. Sites with an elevation equal to or higher than the subject property have been differentiated below from sites with an elevation lower than the subject property (by more than 10 feet). Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking underground storage tank incidents. The data come from the Department of Commerce, Labor & Environmental Resources' Leaking Underground Storage Tanks database.

A review of the LUST list, as provided by EDR, and dated 11/01/1998 has revealed that there are 3 LUST sites within approximately 1 mile of the subject property.

Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
CHARLES MAYO/MAYO'S EXXON	***227 N STATE ROUTE 2***	***1/8 - 1/4 SE***	***1***	***9***
OHIO TWP GARAGE	52746 SR 536	1/2 - 1 WNW	4	11
CITY COMPLEX	***200 LEAP ST***	***1/2 - 1 SSE***	***A8***	***13***

UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the Department of Commerce, Labor & Environmental Resources.

A review of the UST list, as provided by EDR, and dated 03/01/1999 has revealed that there are 7 UST sites within approximately 1 mile of the subject property.

Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
CHARLES MAYO/MAYO'S EXXON	***227 N STATE ROUTE 2***	***1/8 - 1/4 SE***	***1***	***9***
SUPERAMERICA 5170	132 N STATE ROUTE 2	1/4 - 1/2 SSE	2	10
BILL FORBES CHEVROLET INC	108 N STATE ROUTE 2	1/4 - 1/2 SSE	3	10
J C MENSORE DIST INC	134 N BRIDGE ST	1/2 - 1 SSE	5	12
SCHUPBACK'S VALLEY MOTOR CO IN	628 N STATE ROUTE 2	1/2 - 1 NNE	6	12
CITY COMPLEX	***200 LEAP ST***	***1/2 - 1 SSE***	***A8***	***13***
GASSENSHOP	730 N STATE ROUTE 2	1/2 - 1 N	11	14

RCRIS: The Resource Conservation and Recovery Act database includes selected information on sites that generate, store, treat, or dispose of hazardous waste as defined by the Act. The source of this database is the U.S. EPA.

A review of the RCRIS-SQG list, as provided by EDR, and dated 04/26/1999 has revealed that there are 2 RCRIS-SQG sites within approximately 1 mile of the subject property.

Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
CHESAPEAKE & POTOMAC TELEPHONE	***THIRD & WETZEL STS***	***1/2 - 1 SSE***	***7***	***13***
SUNOCO SERVICE STATION	***3RD & LEAP STS***	***1/2 - 1 SSE***	***A9***	***14***

EXECUTIVE SUMMARY

FINDS: The Facility Index System contains both facility information and "pointers" to other sources of information that contain more detail. These include: RCRIS; Permit Compliance System (PCS); Aerometric Information Retrieval System (AIRS); FATES (FIFRA [Federal Insecticide Fungicide Rodenticide Act] and TSCA Enforcement System, FTTS [FIFRA/TSCA Tracking System]; CERCLIS; DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes); Federal Underground Injection Control (FURS); Federal Reporting Data System (FRDS); Surface Impoundments (SIA); TSCA Chemicals in Commerce Information System (CICS); PADS; RCRA-J (medical waste transporters/disposers); TRIS; and TSCA. The source of this database is the U.S. EPA/NTIS.

A review of the FINDS list, as provided by EDR, and dated 04/01/1999 has revealed that there are 3 FINDS sites within approximately 1 mile of the subject property.

Equal/Higher Elevation	Address	Dist / Dir	Map ID	Page
CHESAPEAKE & POTOMAC TELEPHONE	*THIRD & WETZEL STS*	*1/2 - 1 SSE*	*7*	*13*
SUNOCO SERVICE STATION	*3RD & LEAP STS*	*1/2 - 1 SSE*	*A9*	*14*
DALZELL/VIKING GLASS COMPANY	802 PARKWAY	1/2 - 1 SSE	A10	14

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped:

Site Name	Database(s)
HANNIBAL LOCK & DAM	CERC-NFRAP
VALLEY BOAT DOCK (ASHLAND)	LUST
BUDGET INN	LUST
ST JOSEPH MW - 42969	LUST
WETZEL COUNTY SANITARY LANDFILL	MLTS,UST
PANTRY STORE 8	UST
MATLACK INC (NEW MARTINSVILLE)	UST
BUDGET INN	UST
RITE AID CORP	UST
BROWN'S EXXON	UST
ST JOSEPH MW - 42969	UST
NEW MARTINSVILLE YARD	UST
TOYS N JOYS	UST
MAGNOLIA HIGH SCHOOL	UST
C'S QUICK STOP	UST
CERTIFIED OIL #305	UST
STRAWBERRY VINE (CRAFT SHOP)	UST
SCHAMP EXXON	UST
OLD NAPA STORE (NEW RITE-AID)	UST
NEW MARTINSVILLE	UST
ODOT DUFFEY OUTPOST	UST
WETZEL COUNTY LANDFILL	RCRIS-SQG,FINDS
LG WRIGHT GLASS CO	RCRIS-SQG,FINDS
USAR WETZEL COUNTY CENTER	RCRIS-SQG,FINDS
WILLIAM JONES AGENCY	RCRIS-SQG,FINDS
HANNIBAL LOCK AND DAM	ERNS
HANNIBAL LOCK & DAM	ERNS
OHIO RIVER HANNIBAL LOCK & DAM, MILE MARKER 174	ERNS

TOPOGRAPHIC MAP - 389089.1s - Parsons Engineering Science

- Major Roads
- Contour Lines
- Waterways
- Earthquake epicenter, Richter 5 or greater
- Closest Federal Well in quadrant
- Closest State Well in quadrant
- Closest Public Water Supply Well

TARGET PROPERTY:	WV-40, RM 1269, Hannibal DAM	CUSTOMER:	Parsons Engineering Science
ADDRESS:	WV-40, RM 1269, Hannibal DAM	CONTACT:	Mr. Bruce Cox
CITY/STATE/ZIP:	New Martinsville WV 26155	INQUIRY #:	389089.1s
LAT/LONG:	39.6635 / 80.8615	DATE:	July 08, 1999 3:51 pm

GEOCHECK VERSION 2.1
SUMMARY

TARGET PROPERTY COORDINATES

Latitude (North):	39.663502 - 39° 39' 48.6"
Longitude (West):	80.861504 - 80° 51' 41.4"
Universal Transverse Mercator:	Zone 17
UTM X (Meters):	511880.5
UTM Y (Meters):	4390210.0

USGS TOPOGRAPHIC MAP ASSOCIATED WITH THIS SITE

Target Property: 2439080-F7 NEW MARTINSVILLE, WV OH

GEOLOGIC AGE IDENTIFICATION†

Geologic Code:	PP4
Era:	Paleozoic
System:	Pennsylvanian
Series:	Virgilian Series

ROCK STRATIGRAPHIC UNIT†

Category: Stratified Sequence

GROUNDWATER FLOW INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, including well data collected on nearby properties, regional groundwater flow information (from deep aquifers), or surface topography.‡

AQUIFLOW™** Search Radius: 2.000 Miles

MAP ID	DISTANCE FROM TP	DIRECTION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported			

General Topographic Gradient at Target Property: General West

General Hydrogeologic Gradient at Target Property: The hydrogeologic gradient for this report has been determined using the depth to water table information provided below. Where available, the closest well in each quadrant has been identified (up to a radius of 5 miles around the target property) and used in the gradient calculation. While an attempt has been made to segregate shallow from deep aquifers, this cannot always be assured. Groundwater flow in the aquifer associated with the wells appears generally to be to the SW.

FEDERAL DATABASE WELL INFORMATION

WELL QUADRANT	DISTANCE FROM TP	LITHOLOGY	DEPTH TO WATER TABLE
Northern	1/2 - 1 Mile	Alluvium	36 ft.
Eastern	>2 Miles	Not Reported	17 ft.
Southern	1/8 - 1/4 Mile	Alluvium	45 ft.

† Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).
‡ U.S. EPA Ground Water Handbook, Vol I: Ground Water and Contamination, Office of Research and development EPA/625/6-90/016a,Chapter 4, page 78, September 1990.
** EDR AQUIFLOW™ information System of hydrogeologically determined groundwater flow directions at specific locations. See the data pages at the end of this report for a complete description.

GEOCHECK VERSION 2.1
SUMMARY

PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest PWS.
NOTE: PWS System location is not always the same as well location.

PWS Name: OHIO & LEE TWP WATER AUTHORITY
C/O PRESIDENT
PO BOX 182, ST RT 7
HANNIBAL, OH 43931
Location Relative to TP: 1/2 - 1 Mile West
PWS currently has or has had major violation(s) or enforcement: No

AREA RADON INFORMATION

1996 Radon Information:

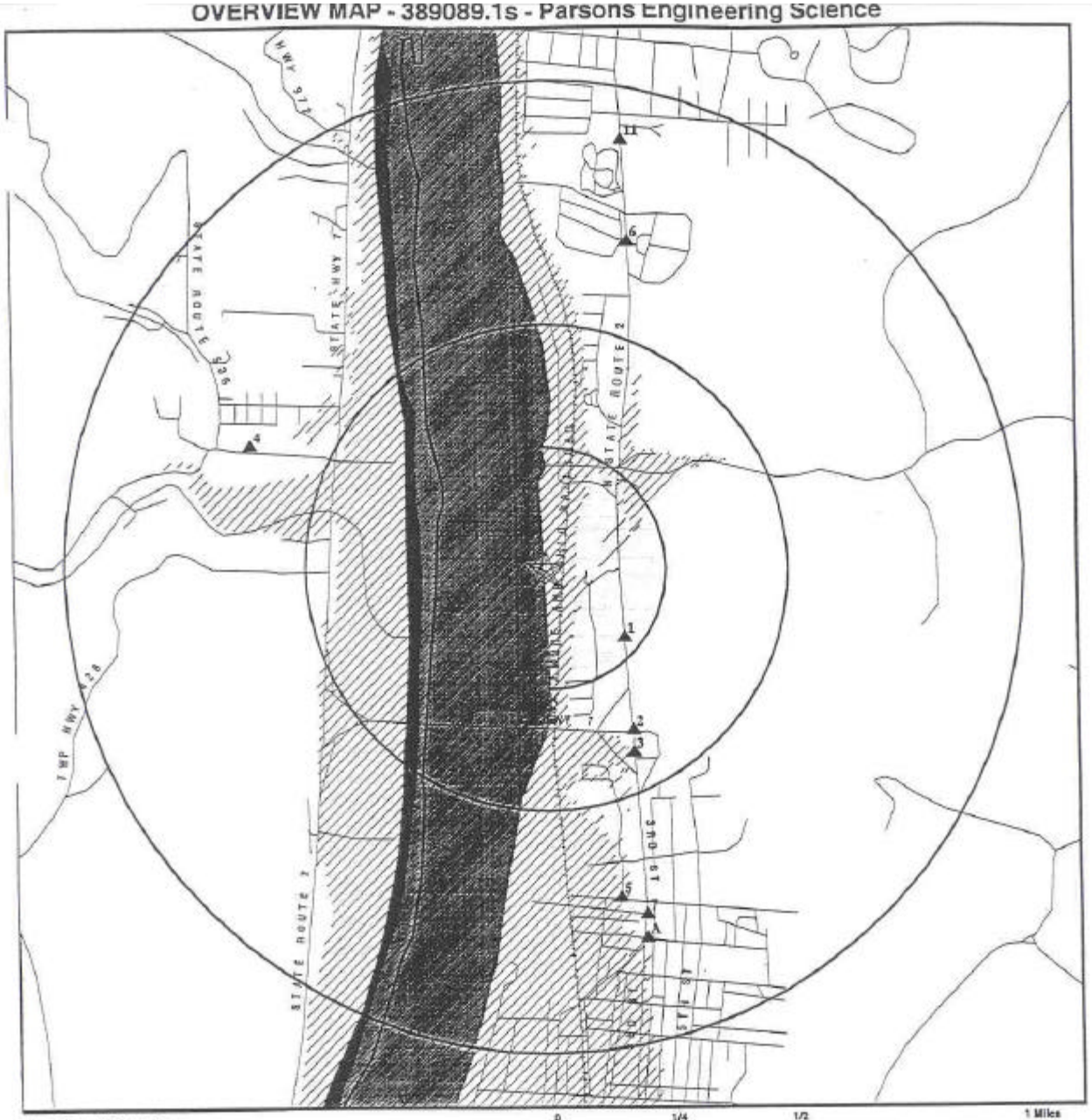
Zip Code: 26155

Number of sites tested: 119.

Maximum Radon Level: 89.6 pCi/L.
Minimum Radon Level: 0.1 pCi/L.

pCi/L <4	pCi/L 4-10	pCi/L 10-20	pCi/L 20-50	pCi/L 50-100	pCi/L >100
90 (75.63%)	20 (16.81%)	3 (2.52%)	4 (3.36%)	2 (1.68%)	0 (0.00%)

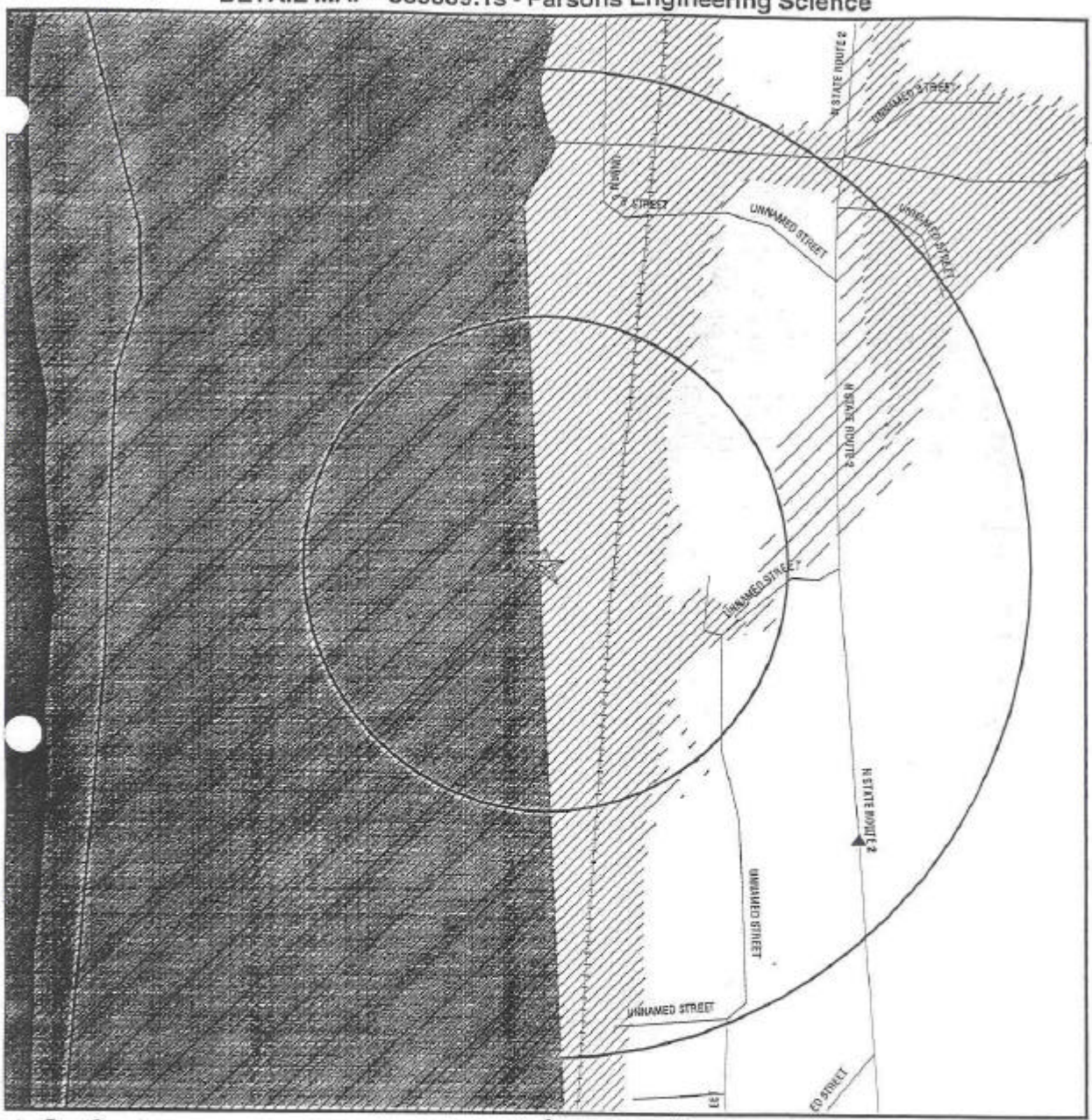
OVERVIEW MAP - 389089.1s - Parsons Engineering Science



- ★ Target Property
- ▲ Sites at elevations higher than or equal to the target property
- ◆ Sites at elevations lower than the target property
- ▲ Coal Gasification Sites (if requested)
- National Priority List Sites
- Landfill Sites
- Power transmission lines
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone
- Wetlands per National Wetlands Inventory (1994)

TARGET PROPERTY:	WV-40, RM 1269, Hannibal DAM	CUSTOMER:	Parsons Engineering Science
ADDRESS:	WV-40, RM 1269, Hannibal DAM	CONTACT:	Mr. Bruce Cox
CITY/STATE/ZIP:	New Martinsville WV 26155	INQUIRY #:	389089.1s
LAT/LONG:	39.6635 / 80.8615	DATE:	July 08, 1999 3:49 pm

DETAIL MAP - 389089.1s - Parsons Engineering Science



- ★ Target Property
- ▲ Sites at elevations higher than or equal to the target property
- • Sites at elevations lower than the target property
- ▲ Coal Gasification Sites (if requested)
- Sensitive Receptors
- National Pricrity List Sites
- Landfill Sites
- Power transmission lines
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone
- Wetlands per National Wetlands Inventory (1994)

TARGET PROPERTY:	WV-40, RM 1269, Hannibal DAM	CUSTOMER:	Parsons Engineering Science
ADDRESS:	WV-40, RM 1269, Hannibal DAM	CONTACT:	Mr. Bruce Cox
CITY/STATE/ZIP:	New Martinsville WV 26155	INQUIRY #:	389089.1s
LAT/LONG:	39.6635 / 80.8615	DATE:	July 08, 1999 3:50 pm

MAP FINDINGS SUMMARY SHOWING ALL SITES

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
NPL		1.000	0	0	0	0	NR	0
Delisted NPL		1.000	0	0	0	0	NR	0
RCRIS-TSD		1.000	0	0	0	0	NR	0
State Haz. Waste		1.000	0	0	0	0	NR	0
CERCLIS		1.000	0	0	0	0	NR	0
CERC-NFRAP		1.000	0	0	0	0	NR	0
CORRACTS		1.000	0	0	0	0	NR	0
State Landfill		1.000	0	0	0	0	NR	0
LUST		1.000	0	1	0	2	NR	3
UST		1.000	0	1	2	4	NR	7
RAATS		1.000	0	0	0	0	NR	0
RCRIS Sm. Quan. Gen.		1.000	0	0	0	2	NR	2
RCRIS Lg. Quan. Gen.		1.000	0	0	0	0	NR	0
HMIRS		1.000	0	0	0	0	NR	0
PADS		1.000	0	0	0	0	NR	0
ERNS		1.000	0	0	0	0	NR	0
FINDS		1.000	0	0	0	3	NR	3
TRIS		1.000	0	0	0	0	NR	0
NPL Liens		1.000	0	0	0	0	NR	0
TSCA		1.000	0	0	0	0	NR	0
MLTS		1.000	0	0	0	0	NR	0
ROD		1.000	0	0	0	0	NR	0
CONSENT		1.000	0	0	0	0	NR	0
Coal Gas		1.000	0	0	0	0	NR	0
MINES		1.000	0	0	0	0	NR	0

TP = Target Property

NR = Not Requested at this Search Distance

* Sites may be listed in more than one database

MAP FINDINGS SUMMARY SHOWING ONLY SITES HIGHER THAN OR THE SAME ELEVATION AS TP

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
NPL		1.000	0	0	0	0	NR	0
Delisted NPL		1.000	0	0	0	0	NR	0
RCRIS-TSD		1.000	0	0	0	0	NR	0
State Haz. Waste		1.000	0	0	0	0	NR	0
CERCLIS		1.000	0	0	0	0	NR	0
CERC-NFRAP		1.000	0	0	0	0	NR	0
CORRACTS		1.000	0	0	0	0	NR	0
State Landfill		1.000	0	0	0	0	NR	0
LUST		1.000	0	1	0	2	NR	3
UST		1.000	0	1	2	4	NR	7
RAATS		1.000	0	0	0	0	NR	0
RCRIS Sm. Quan. Gen.		1.000	0	0	0	2	NR	2
RCRIS Lg. Quan. Gen.		1.000	0	0	0	0	NR	0
HMIRS		1.000	0	0	0	0	NR	0
PADS		1.000	0	0	0	0	NR	0
ERNS		1.000	0	0	0	0	NR	0
FINDS		1.000	0	0	0	3	NR	3
TRIS		1.000	0	0	0	0	NR	0
NPL Liens		1.000	0	0	0	0	NR	0
TSCA		1.000	0	0	0	0	NR	0
MLTS		1.000	0	0	0	0	NR	0
ROD		1.000	0	0	0	0	NR	0
CONSENT		1.000	0	0	0	0	NR	0
Coal Gas		1.000	0	0	0	0	NR	0
MINES		1.000	0	0	0	0	NR	0

TP = Target Property

NR = Not Requested at this Search Distance

* Sites may be listed in more than one database

Coal Gas Site Search: No site was found in a search of Real Property Scan's ENVIROHAZ database.

1
SE
1/8-1/4
1122
Higher

CHARLES MAY0/MAYO'S EXXON
227 N STATE ROUTE 2
NEW MARTINSVILLE, WV 26155

UST
LUST

U003349450
N/A

LUST:
Facility ID: 93-112

UST:
Facility ID: 5205790
Owner: HESS OIL CO INC
Owner Address: 227 N STATE RT 2
New Martinsville, WV 26155
Owner Phone: (304) 455-3770
Tank ID: 1
Tank Capacity: 20000
Tank Material: Cathodically Protected Steel
Tank Status: Currently in Use

Facility ID: 5205790
Owner: HESS OIL CO INC
Owner Address: 227 N STATE RT 2
New Martinsville, WV 26155
Owner Phone: (304) 455-3770
Tank ID: 2
Tank Capacity: 4000
Tank Material: Asphalt Coated or Bare Steel
Tank Status: Permanently Out of Use

Facility ID: 5205790
Owner: HESS OIL CO INC
Owner Address: 227 N STATE RT 2
New Martinsville, WV 26155
Owner Phone: (304) 455-3770
Tank ID: 3
Tank Capacity: 8000
Tank Material: Asphalt Coated or Bare Steel
Tank Status: Permanently Out of Use

Facility ID: 5205790
Owner: HESS OIL CO INC
Owner Address: 227 N STATE RT 2
New Martinsville, WV 26155
Owner Phone: (304) 455-3770
Tank ID: 4
Tank Capacity: 8000
Tank Material: Asphalt Coated or Bare Steel
Tank Status: Permanently Out of Use

Map ID / Direction / Distance / Distance (ft.) / Elevation	Site	Database(s)	EDR ID Number / EPA ID Number
	CHARLES MAYO/MAYO'S EXXON (Continued)		**U003349450**
	Facility ID: 5205790 Owner: HESS OIL CO INC Owner Address: 227 N STATE RT 2 New Martinsville, WV 26155 Owner Phone: (304) 455-3770 Tank ID: 5 Tank Capacity: 1000 Tank Material: Asphalt Coated or Bare Steel Tank Status: Permanently Out of Use		
2 SSE 1/4-1/2 1982 Higher	**SUPERAMERICA 5170** **132 N STATE ROUTE 2** **NEW MARTINSVILLE, WV 26155**	UST	**U003439188** **N/A**
3 SSE 1/4-1/2 2201 Higher	**BILL FORBES CHEVROLET INC** **108 N STATE ROUTE 2** **NEW MARTINSVILLE, WV 26155**	UST	**U003349451** **N/A**
	UST: Facility ID: 5205791 Owner: SAMMY'S MOBIL SERVICE INC Owner Address: PO BOX 460 New Martinsville, WV 26155 Owner Phone: (304) 455-2727 Tank ID: 1 Tank Capacity: 1000 Tank Material: Asphalt Coated or Bare Steel Tank Status: Permanently Out of Use		
	Facility ID: 5205791 Owner: SAMUEL & DEBRA MILLER Owner Address: PO BOX 460 New Martinsville, WV 26155 Owner Phone: (304) 455-2727 Tank ID: 2 Tank Capacity: 285 Tank Material: Asphalt Coated or Bare Steel Tank Status: Permanently Out of Use		
	Facility ID: 5205791 Owner: SAMUEL & DEBRA MILLER Owner Address: PO BOX 460 New Martinsville, WV 26155 Owner Phone: (304) 455-2727 Tank ID: 3 Tank Capacity: 285 Tank Material: Asphalt Coated or Bare Steel Tank Status: Permanently Out of Use		

BILL FORBES CHEVROLET INC (Continued) U003349451

Facility ID: 5205791
Owner: SAMUEL & DEBRA MILLER
Owner Address: PO BOX 460
New Martinsville, WV 26155
Owner Phone: (304) 455-2727
Tank ID: 4
Tank Capacity: 285
Tank Material: Asphalt Coated or Bare Steel
Tank Status: Permanently Out of Use

Facility ID: 5205791
Owner: SAMUEL GERARD III
Owner Address: PO BOX 460
New Martinsville, WV 26155
Owner Phone: (304) 455-2727
Tank ID: 5
Tank Capacity: 285
Tank Material: Not Listed
Tank Status: Permanently Out of Use

Facility ID: 5205791
Owner: SAMUEL GERARD III
Owner Address: PO BOX 460
New Martinsville, WV 26155
Owner Phone: (304) 455-2727
Tank ID: 6
Tank Capacity: 4000
Tank Material: Asphalt Coated or Bare Steel
Tank Status: Permanently Out of Use

Facility ID: 5205791
Owner: SAND SPRINGS CAMPING AREA
Owner Address: PO BOX 460
New Martinsville, WV 26155
Owner Phone: (304) 455-2727
Tank ID: 7
Tank Capacity: 4000
Tank Material: Asphalt Coated or Bare Steel
Tank Status: Permanently Out of Use

Facility ID: 5205791
Owner: SAND SPRINGS CAMPING AREA
Owner Address: PO BOX 460
New Martinsville, WV 26155
Owner Phone: (304) 455-2727
Tank ID: 8
Tank Capacity: 2100
Tank Material: Not Listed
Tank Status: Permanently Out of Use

4
WNW
1/2-1
3505
Higher

OHIO TWP GARAGE
52746 SR 536
HANNIBAL, OH 43931

LUST

S102736042
N/A

OHIO TWP GARAGE (Continued) S102736042

LUST:

Facility ID:	560032	Incident ID:	562238400
Report No:	5622384	Facility Track:	0
Facility Tel:	Not reported	Responsibility:	Not reported
Owner:	Not reported		
Owner Address:	OH		
Owner Phone:	Not reported		
Operator:	Not reported		
Operator Addr:	OH		
Operator Phone:	Not reported		
Inspector:	Not reported	Revised Date:	03/04/98
Fiscal Track:	FY92	Coordinator:	FICH
Facility Status:	No Further Action letter issued		
Classification:	Known suspected or confirmed source and responsible person is voluntarily, or under an informal enforcement action, proceeding with investigation of corrective actions.		
Trust Fund:	Closure of an underground storage tank.		
Emerg Respnse:	2	Response By:	Not reported
Authorized By:	GILL	Authorize Date:	01/29/98
Added Date:	09/30/92	Entry By:	UNGER
Response Srch:	Not reported	Priority:	2
Vacant:	Not reported		
Remarks:	Not reported		
Summary:	Not reported		

5
SSE
1/2-1
3650
Higher

J C MENSORE DIST INC UST U003349456
134 N BRIDGE ST N/A
NEW MARTINSVILLE, WV 26155

UST:

Facility ID:	5205804
Owner:	SANSOM'S SUNOCO
Owner Address:	134 N BRIDGE ST
	New Martinsville, WV 26155
Owner Phone:	(304) 455-1890
Tank ID:	1
Tank Capacity:	1000
Tank Material:	Asphalt Coated or Bare Steel
Tank Status:	Permanently Out of Use

Facility ID:	5205804
Owner:	SARA MILLER
Owner Address:	134 N BRIDGE ST
	New Martinsville, WV 26155
Owner Phone:	(304) 455-1890
Tank ID:	2
Tank Capacity:	1000
Tank Material:	Asphalt Coated or Bare Steel
Tank Status:	Permanently Out of Use

6
NNE
1/2-1
3674
Higher

SCHUPBACK'S VALLEY MOTOR CO INC UST U003349459
628 N STATE ROUTE 2 N/A
NEW MARTINSVILLE, WV 26155

SCHUPBACK'S VALLEY MOTOR CO INC (Continued) U003349459

UST:
Facility ID: 5205812
Owner: SCHNEIDER CONSTRUCTION CO
Owner Address: 628 NO ST RT 2
New Martinsville, WV 26155
Owner Phone: (304) 455-4343
Tank ID: 1
Tank Capacity: 1000
Tank Material: Asphalt Coated or Bare Steel
Tank Status: Permanently Out of Use

Facility ID: 5205812
Owner: SCHUPBACK'S VALLEY MOTOR CO INC
Owner Address: 628 NO ST RT 2
New Martinsville, WV 26155
Owner Phone: (304) 455-4343
Tank ID: 2
Tank Capacity: 1000
Tank Material: Asphalt Coated or Bare Steel
Tank Status: Permanently Out of Use

7
SSE
1/2-1
3900
Higher

CHESAPEAKE & POTOMAC TELEPHONE
THIRD & WETZEL STS
NEW MARTINSVILL, WV 26155

RCRIS-SQG 1000377413
FINDS WVD980555817

RCRIS:
Owner: CHESAPEAKE & POTOMAC TELEPHONE
(215) 555-1212
Contact: TERRY_E BARTLEY
(202) 392-8284
Record Date: 12/08/1981
Classification: Not reported
Used Oil Recyc: No
Violation Status: No violations found

A8
SSE
1/2-1
4134
Higher

CITY COMPLEX
200 LEAP ST
NEW MARTINSVILLE, WV 26155

UST U000580006
LUST N/A

LUST:
Facility ID: 93-244

CITY COMPLEX (Continued) U000680006

UST:
Facility ID: 5205806
Owner: SAUL CONSTRUCTION
Owner Address: 191 MAIN ST
New Martinsville, WV 26155
Owner Phone: (304) 455-9120
Tank ID: 1
Tank Capacity: 2000
Tank Material: Asphalt Coated or Bare Steel
Tank Status: Permanently Out of Use

Facility ID: 5205806
Owner: SAYRES STORE
Owner Address: 191 MAIN ST
New Martinsville, WV 26155
Owner Phone: (304) 455-9120
Tank ID: 2
Tank Capacity: 1000
Tank Material: Asphalt Coated or Bare Steel
Tank Status: Permanently Out of Use

A9
SSE
1/2-1
4145
Higher

SUNOCO SERVICE STATION
3RD & LEAP STS
NEW MARTINSVILL, WV 26155

RCRIS-SQG 1000329931
FINDS WVD000755033

RCRIS:
Owner: SUN OIL COMPANY OF PA
(215) 555-1212
Contact: DON GRAY
(301) 341-0100
Record Date: 08/18/1980
Classification: Not reported
Used Oil Recyc: No
Violation Status: No violations found

A10
SSE
1/2-1
4247
Higher

DALZELL/VIKING GLASS COMPANY
802 PARKWAY
NEW MARTINSVILL, WV 26155

FINDS 1001401807
WV0903615

FINDS:
Other Pertinent Environmental Activity Identified at Site:
AIRS Facility System (AIRS/AFS)

11
North
1/2-1
4726
Higher

GASSENSHOP
730 N STATE ROUTE 2
NEW MARTINSVILLE, WV 26155

UST U003349447
N/A

GASSENSHOP (Continued) U003349447

UST:

Facility ID:	5205780
Owner:	SAMATHA O BENNETT
Owner Address:	730 N STATE RT 2
	New Martinsville, WV 26155
Owner Phone:	(304) 455-5809
Tank ID:	1
Tank Capacity:	8000
Tank Material:	Asphalt Coated or Bare Steel
Tank Status:	Currently in Use

Facility ID:	5205780
Owner:	SAMATHA O BENNETT
Owner Address:	730 N STATE RT 2
	New Martinsville, WV 26155
Owner Phone:	(304) 455-5809
Tank ID:	2
Tank Capacity:	8000
Tank Material:	Asphalt Coated or Bare Steel
Tank Status:	Currently in Use

Facility ID:	5205780
Owner:	SAMMY O'NEIL
Owner Address:	730 N STATE RT 2
	New Martinsville, WV 26155
Owner Phone:	(304) 455-5809
Tank ID:	3
Tank Capacity:	4000
Tank Material:	Asphalt Coated or Bare Steel
Tank Status:	Currently in Use

Facility ID:	5205780
Owner:	SAMMY O'NEIL
Owner Address:	730 N STATE RT 2
	New Martinsville, WV 26155
Owner Phone:	(304) 455-5809
Tank ID:	4
Tank Capacity:	2000
Tank Material:	Asphalt Coated or Bare Steel
Tank Status:	Currently in Use

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)	Facility ID
DUFFY	S100557486	VALLEY BOAT DOCK (ASHLAND)	RT 7	43946	LUST	-0-
NEW MARTINSVILL	1000821361	WETZEL COUNTY LANDFILL	CIDER RUN RD OFF RTE 180	26155	RCRIS-SQG, FINDS	
NEW MARTINSVILL	1000438647	LG WRIGHT GLASS CO	S STATE RT 2	26155	RCRIS-SQG, FINDS	
NEW MARTINSVILLE	1000491529	WETZEL COUNTY SANITARY LANDFILL	ROUTE 1, BOX 156A	26155	MLTS, UST	5206743
NEW MARTINSVILLE	1000482007	HANNIBAL LOCK & DAM	MP 126.4 NEW MARTINSVILLE	26155	CERC-NFRAP	
NEW MARTINSVILLE	S102591022	BUDGET INN	RT 2 PAKWAY / LEAP ST	26155	LUST	97-041
NEW MARTINSVILLE	U003439191	PANTRY STORE 8	RT 2 & 3RD ST 312 NORTH ST	26155	UST	
NEW MARTINSVILLE	U003439213	MATLACK INC (NEW MARTINSVILLE)	RT 2 & UNION ST	26155	UST	
NEW MARTINSVILLE	U003439241	BUDGET INN	RT 2 PAKWAY & LEAP ST	26155	UST	
NEW MARTINSVILLE	U003439592	RITE AID CORP	RT 2 & BENJAMIN LANE	26155	UST	
NEW MARTINSVILLE	U003439216	BROWN'S EXXON	RT 20	26155	UST	
NEW MARTINSVILLE	S103391571	ST JOSEPH MW - 42989	RT 21	26155	LUST	94-215
NEW MARTINSVILLE	U003437341	ST JOSEPH MW - 42989	RT 21	26155	UST	
NEW MARTINSVILLE	U003438957	NEW MARTINSVILLE YARD	FOOT OF WETZEL STREET	26155	UST	
NEW MARTINSVILLE	91224529	HANNIBAL LOCK AND DAM	HANNIBAL LOCK AND DAM		ERNS	
NEW MARTINSVILLE	90172376	HANNIBAL LOCK & DAM	HANNIBAL LOCK & DAM		ERNS	
NEW MARTINSVILLE	U003439229	TOYS N JOYS	MAIN ST NORTH	26155	UST	
NEW MARTINSVILLE	U000580023	MAGNOLIA HIGH SCHOOL	MAPLE AVENUE	26155	UST	5205827
NEW MARTINSVILLE	92298295	OHIO RIVER HANNIBAL LOCK & DAM, MILE MARKER 174	OHIO RIVER HANNIBAL LOCK & DAM, MILE MARKER 174		ERNS	
NEW MARTINSVILLE	U003127148	C'S QUICK STOP	ST RT 17	26155	UST	5208605
NEW MARTINSVILLE	U003439187	CERTIFIED OIL #305	ST RT 2 & 7 SECONDARY RT 247	26155	UST	
NEW MARTINSVILLE	U003439230	STRAWBERRY VINE (CRAFT SHOP)	ST RT 2	26155	UST	
NEW MARTINSVILLE	1000352065	USAR WETZEL COUNTY CENTER	1370 N ST RT 2	26155	RCRIS-SQG, FINDS	
NEW MARTINSVILLE	U000679988	SCHAMP EXXON	STATE RT 2	26155	UST	5205768
NEW MARTINSVILLE	U003439615	OLD NAPA STORE (NEW RITE-AID)	520 N STATE ST	26155	UST	
NEW MARTINSVILLE	U003439204	NEW MARTINSVILLE	THIRD & WETZEL	26155	UST	
SARDIS	U000697395	ODOT DUFFEY OUTPOST	ST RT 7	43946	UST	0-583113
SARDIS	1000284004	WILLIAM JONES AGENCY	ST RTE 7	43946	RCRIS-SQG, FINDS	

GEOCHECK VERSION 2.1 ADDENDUM
FEDERAL DATABASE WELL INFORMATION

Well Closest to Target Property (Northern Quadrant)

BASIC WELL DATA

Site ID:	394018080513601	Distance from TP:	1/2 - 1 Mile
Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	1957	County:	Not Reported
Altitude:	645.00 ft.	State:	Not Reported
Well Depth:	82.00 ft.	Topographic Setting:	Flood plain
Depth to Water Table:	35.70 ft.	Prim. Use of Site:	Withdrawal of water
Date Measured:	11011980	Prim. Use of Water:	Public supply

LITHOLOGIC DATA

Geologic Age ID (Era/System/Series):	Cenozoic-Quaternary-Holocene
Principal Lithology of Unit:	Alluvium
Further Description:	Not Reported

WATER LEVEL VARIABILITY

Not Reported

GEOCHECK VERSION 2.1
FEDERAL DATABASE WELL INFORMATION

Well Closest to Target Property (Eastern Quadrant)

BASIC WELL DATA

Site ID:	394136080481201	Distance from TP:	>2 Miles
Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	Not Reported	County:	Not Reported
Altitude:	680.00 ft.	State:	Not Reported
Well Depth:	83.00 ft.	Topographic Setting:	Valley flat
Depth to Water Table:	17.00 ft.	Prim. Use of Site:	Withdrawal of water
Date Measured:	Not Reported	Prim. Use of Water:	Not Reported

LITHOLOGIC DATA

Geologic Age ID (Era/System/Series):	Pennsylvanian-Upper
Principal Lithology of Unit:	Not Reported
Further Description:	Not Reported

WATER LEVEL VARIABILITY

Not Reported

GEOCHECK VERSION 2.1
FEDERAL DATABASE WELL INFORMATION

Well Closest to Target Property (Southern Quadrant)

BASIC WELL DATA

Site ID:	393937080513801	Distance from TP:	1/8 - 1/4 Mile
Site Type:	Single well, other than collector or Ranney type		
Year Constructed:	1975	County:	Not Reported
Altitude:	640.00 ft.	State:	Not Reported
Well Depth:	74.50 ft.	Topographic Setting:	Flood plain
Depth to Water Table:	45.00 ft.	Prim. Use of Site:	Withdrawal of water
Date Measured:	12111975	Prim. Use of Water:	Public supply

LITHOLOGIC DATA

Geologic Age ID (Era/System/Series):	Cenozoic-Quaternary-Holocene
Principal Lithology of Unit:	Alluvium
Further Description:	Not Reported

WATER LEVEL VARIABILITY

Not Reported

GEOCHECK VERSION 2.1
PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest PWS.

PWS SUMMARY:

PWS ID:	OH5600412	PWS Status:	Active	Distance from TP:	1/2 - 1 Mile
Date Initiated:	Not Reported	Date Deactivated:	Not Reported	Dir relative to TP:	West
PWS Name:	OHIO & LEE TWP WATER AUTHORITY C/O PRESIDENT PO BOX 182, ST RT 7 HANNIBAL, OH 43931				
Addressee / Facility:	Not Reported				
Facility Latitude:	39 40 01		Facility Longitude:	080 52 19	
City Served:	Not Reported				
Treatment Class:	Treated		Population Served:	1,001 - 2,500 Persons	

PWS currently has or has had major violation(s) or enforcement: No

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Elapsed ASTM days: Provides confirmation that this EDR report meets or exceeds the 90-day updating requirement of the ASTM standard.

FEDERAL ASTM RECORDS:

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System
Source: EPA
Telephone: 703-413-0223
CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 04/21/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Quarterly

Date of Data Arrival at EDR: 05/14/99
Elapsed ASTM days: 26
Date of Last EDR Contact: 05/14/99

ERNS: Emergency Response Notification System
Source: EPA/NTIS
Telephone: 202-260-2342
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/31/98
Date Made Active at EDR: 01/18/99
Database Release Frequency: Quarterly

Date of Data Arrival at EDR: 01/13/99
Elapsed ASTM days: 5
Date of Last EDR Contact: 05/12/99

NPL: National Priority List
Source: EPA
Telephone: N/A
National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC).

Date of Government Version: 05/10/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 05/12/99
Elapsed ASTM days: 28
Date of Last EDR Contact: 05/12/99

RCRIS: Resource Conservation and Recovery Information System
Source: EPA/NTIS
Telephone: 800-424-9346
Resource Conservation and Recovery Information System. RCRIS includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA).

Date of Government Version: 04/26/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 05/14/99
Elapsed ASTM days: 26
Date of Last EDR Contact: 05/14/99

CORRACTS: Corrective Action Report
Source: EPA
Telephone: 800-424-9346
CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/01/99
Date Made Active at EDR: 04/16/99
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 03/17/99
Elapsed ASTM days: 30
Date of Last EDR Contact: 06/21/99

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FEDERAL NON-ASTM RECORDS:

BRS: Biennial Reporting System
Source: EPA/NTIS
Telephone: 800-424-9346
The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/95
Database Release Frequency: Biennially
Date of Last EDR Contact: 03/25/99
Date of Next Scheduled EDR Contact: 06/21/99

CONSENT: Superfund (CERCLA) Consent Decrees
Source: EPA Regional Offices
Telephone: Varies
Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: Varies
Database Release Frequency: Varies
Date of Last EDR Contact: Varies
Date of Next Scheduled EDR Contact: N/A

FINDS: Facility Index System/Facility Identification Initiative Program Summary Report
Source: EPA
Telephone: N/A
Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 04/01/99
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/16/99
Date of Next Scheduled EDR Contact: 07/12/99

HMIRS: Hazardous Materials Information Reporting System
Source: U.S. Department of Transportation
Telephone: 202-366-4526
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 12/31/97
Database Release Frequency: Annually
Date of Last EDR Contact: 03/24/99
Date of Next Scheduled EDR Contact: 07/26/99

MLTS: Material Licensing Tracking System
Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 12/08/98
Database Release Frequency: Quarterly
Date of Last EDR Contact: 04/13/99
Date of Next Scheduled EDR Contact: 07/12/99

NPL LIENS: Federal Superfund Liens
Source: EPA
Telephone: 205-564-4267
Federal Superfund Liens. Under the authority granted the USEPA by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner receives notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/91
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 05/28/98
Date of Next Scheduled EDR Contact: 08/23/99

PADS: PCB Activity Database System
Source: EPA
Telephone: 202-260-3936
PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 09/22/97
Database Release Frequency: No Update Planned

Date of Last EDR Contact: 05/27/99
Date of Next Scheduled EDR Contact: 08/16/99

RAATS: RCRA Administrative Action Tracking System
Source: EPA
Telephone: 202-564-4104
RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/95
Database Release Frequency: No Update Planned

Date of Last EDR Contact: 06/14/99
Date of Next Scheduled EDR Contact: 09/13/99

ROD: Records Of Decision
Source: NTIS
Telephone: 703-416-0223
Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 01/31/99
Database Release Frequency: Annually

Date of Last EDR Contact: 05/25/99
Date of Next Scheduled EDR Contact: 07/19/99

TRIS: Toxic Chemical Release Inventory System
Source: EPA
Telephone: 202-260-1531
Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/97
Database Release Frequency: Annually

Date of Last EDR Contact: 05/07/99
Date of Next Scheduled EDR Contact: 06/28/99

TSCA: Toxic Substances Control Act
Source: EPA
Telephone: 202-260-1444
Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/94
Database Release Frequency: Every 4 Years

Date of Last EDR Contact: 04/26/99
Date of Next Scheduled EDR Contact: 07/26/99

MINES: Mines Master Index File
Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959

Date of Government Version: 08/01/98
Database Release Frequency: Semi-Annually

Date of Last EDR Contact: 04/08/99
Date of Next Scheduled EDR Contact: 07/05/99

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

STATE OF WEST VIRGINIA ASTM RECORDS:

LUST: Leaking Underground Storage Tanks
Source: Division of Environmental Protection
Telephone: 304-558-4253
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 11/01/98
Date Made Active at EDR: 01/29/99
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 12/29/98
Elapsed ASTM days: 31
Date of Last EDR Contact: 06/08/99

SHWS: State Hazardous Waste Sites
Source: Department of Commerce, Labor and Environmental Resources
Telephone: 703-603-8904
State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: 04/21/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Quarterly

Date of Data Arrival at EDR: 05/14/99
Elapsed ASTM days: 26
Date of Last EDR Contact: 03/29/99

LF: List of M.S.W. Landfills/Transfer Station Listing
Source: Division of Environmental Protection
Telephone: 304-558-6350
Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 01/15/99
Date Made Active at EDR: 03/05/99
Database Release Frequency: Annually

Date of Data Arrival at EDR: 02/08/99
Elapsed ASTM days: 25
Date of Last EDR Contact: 05/04/99

UST: UST Database
Source: Division of Environmental Protection
Telephone: 304-759-0515
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 03/01/99
Date Made Active at EDR: 04/23/99
Database Release Frequency: Annually

Date of Data Arrival at EDR: 03/23/99
Elapsed ASTM days: 31
Date of Last EDR Contact: 06/22/99

Historical and Other Database(s)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Former Manufactured Gas (Coal Gas) Sites: The existence and location of Coal Gas sites is provided exclusively to EDR by Real Property Scan, Inc. For a technical description of the types of hazards which may be found at such sites, contact your EDR customer service representative.

Disclaimer Provided by Real Property Scan, Inc.

The information contained in this report has predominantly been obtained from publicly available sources produced by entities other than Real Property Scan. While reasonable steps have been taken to insure the accuracy of this report, Real Property Scan does not guarantee the accuracy of this report. Any liability on the part of Real Property Scan is strictly limited to a refund of the amount paid. No claim is made for the actual existence of toxins at any site. This report does not constitute a legal opinion.

DELISTED NPL: NPL Deletions
Source: EPA
Telephone: N/A
The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 04/23/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Semi-Annually

Date of Data Arrival at EDR: 05/12/99
Elapsed ASTM days: 28
Date of Last EDR Contact: 02/08/99

NFRAP: No Further Remedial Action Planned
Source: EPA
Telephone: 703-413-0223
As of February 1995, CERCLIS sites designated "No Further Remedial Action Planned" (NFRAP) have been removed from CERCLIS. NFRAP sites may be sites where, following an initial investigation, no contamination was found, contamination was removed quickly without the need for the site to be placed on the NPL, or the contamination was not serious enough to require Federal Superfund action or NPL consideration. EPA has removed approximately 25,000 NFRAP sites to lift the unintended barriers to the redevelopment of these properties and has archived them as historical records so EPA does not needlessly repeat the investigations in the future. This policy change is part of the EPA's Brownfields Redevelopment Program to help cities, states, private investors and affected citizens to promote economic redevelopment of unproductive urban sites.

Date of Government Version: 04/21/99
Date Made Active at EDR: 06/09/99
Database Release Frequency: Quarterly

Date of Data Arrival at EDR: 05/14/99
Elapsed ASTM days: 26
Date of Last EDR Contact: 05/14/99

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-260-2805
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-260-2805
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SWDIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

Area Radon Information: The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones: Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

Statistical Summary Readings: Radon readings for Delaware, D.C., Maryland, Pennsylvania, Virginia and West Virginia. EPA Region 3.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Oil/Gas Pipelines/Electrical Transmission Lines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines and electrical transmission lines.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

USGS Water Wells: In November 1971 the United States Geological Survey (USGS) implemented a national water resource information tracking system. This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on more than 900,000 wells, springs, and other sources of groundwater.

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in March 1997 from the U.S. Fish and Wildlife Service.

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Water Dams: National Inventory of Dams
Source: Federal Emergency Management Agency
Telephone: 202-646-2801
National computer database of more than 74,000 dams maintained by the Federal Emergency Management Agency.

APPENDIX C Plan Formulation and Incremental Analysis Checklist

Project Site Location:

The proposed Hannibal Dam Tailwater Revetments project area is located in Wetzel County, West Virginia within the City of New Martinsville, West Virginia. The project site is immediately downstream (south) from the Hannibal Locks and Dam in the Ohio River Willow Island Pool between Ohio River Mile (ORM) 126.9 and 128.5. The project site is within the jurisdiction of the Huntington District, U.S. Army Corps of Engineers (USACE).

Description of Plan selected:

The Hannibal Dam Tailwater Revetments project will consist of three primary elements including: 1) Construct two boulder (rip-rap) revetments that runs parallel/adjacent to the east bank of the Ohio River from the handicap fishing pier downstream approximately 600 feet; 2) Construct three off-shore revetment(rip-rap) structures near the restricted access buoy line; and 3) Dredge the mouth of Williams Run to provide a deep water outlet for the City of New Martinsville stormwater system and enhance bank fishing opportunities.

The hard point structures will be constructed at various depths and at various distances from the shoreline to maximize habitat heterogeneity. The off-shore revetments will provide habitat diversity, winter velocity shelters for fishes, and hard structure for bank and boat fishermen.

Alternatives of the Selected Plan:

Smaller Size Plans Possible? Yes and description

Reduce the number of rip-rap structures.

Larger Size Plan Possible? Yes and description

Increase the size and number of rock structures.

Other alternatives? No

Restore/Enhance/Protect Terrestrial Habitats? [ ] **Opportunity numbers met** [ ]

Restore, Enhance, & Protect Wetlands? [ ] **Opportunity numbers met** [ ]

Restore/Enhance/Protect Aquatic Habitats? [Yes] **Opportunity numbers met** [A4, A5, A6]

Type species benefited: Fish and invertebrates including mussels.

Endangered species benefited: none

Can estimated amount of habitat units be determined:

Plan acceptable to Resources Agencies?
U.S. Fish & Wildlife Service?
State Department of Natural Resources? Yes – West Virginia DNR
Plan considered complete? **Connected to other plans for restoration?**
Real Estate owned by State Agency? **Federal Agency?**
Real Estate privately owned? No
If privately owned, what is status of future acquisition?

Terrestrial Habitat Opportunities

T1- Restore riparian corridors, reduce fragmentation by expanding and joining isolated habitat blocks and stabilize eroding banks.

T2 Restore, protect existing islands and create islands where they historically occurred.

T3 Restore hardwood forests in the 100-year floodplain.

Wetland Habitat Opportunities

W1 Forested Wetlands: Restore Forested Wetlands: Bottomland Hardwoods

W2 Forested Wetlands: Restore Forested Wetlands:Cypress/Tupelo Swamps and other unique forested wetlands

W3 Restore Scrub/Shrub Emergent Wetlands: including those areas isolated from the river except during high water and those contiguous with embayments and island sloughs.

Aquatic Habitat Opportunities

A1 Restore backwaters (Including sloughs, embayments, oxbows, bayous, etc.).

A2 Restore riverine submerged and emergent aquatic vegetation

A3 Restore and protect sand and gravel bars.

A4 Protect tailwaters and provide structures to provide refuge for fish.

A5 Create and protect fish and mussel refuges in pools (deep water, slow velocity, soft substrate)

A6 Restore and protect aquatic habitat (Side Channel/Back Channel Habitat)

Other

O-1 Restore other habitats(e.g., canebrakes, river bluffs mussel beds, etc.)

APPENDIX D Micro Computer-Aided Cost Engineering System (MCACES)

Hannibal Dam
Ohio River Mainstem
Ecosystem Restoration Project

Sample Feasibility Cost Estimate

Designed By: Parsons Engineering Science, Inc
Estimated By:

Prepared By: Parsons Engineering/CELRL-ED-MC
CELRL-ED-MC POC: M. Lockard

Preparation Date: 06/20/00
Effective Date of Pricing: 06/20/00
Est Construction Time: 180 Days

Sales Tax: 0.00%

M C A C E S G O L D E D I T I O N
Composer GOLD Software Copyright (c) 1985-1994
by Building Systems Design, Inc.
Release 5.30A

LABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

Hannibal Dam Tailwater Revet	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
Lands and Damages					0	0	0	28,825	28,825	
Habitat & Feeding Facilities										
Mobilization										
Dredge	2.00	LS		0.53	5,800	8,700	0	0	14,500	7250.00
Bull Dozer	2.00	LS		6.00	59	304	0	0	363	181.50
Vibrating Roller	2.00	LS		6.00	59	304	0	0	363	181.50
Offshore Revetment Equipment	1.00	LS		1.00	0	0	0	20,000	20,000	20000
Mobilization					5,918	9,308	0	20,000	35,226	
Dredging										
AUGERHD MUDCAT, 8" DISCHARGE DIA	219.00	HR	M10EL007	0.00	0	10,303	0	0	10,303	47.04
Outside Laborer	438.00	HR	X-LABORER	0.00	9,990	0	0	0	9,990	22.81
Outside Equip. Op. Medium	219.00	HR	X-EQOPRMED	0.00	4,435	0	0	0	4,435	20.25
Dredging	13140	CY			14,425	10,303	0	0	24,728	1.88
Geotube Levee										
Bulk Site Exc & Shaping, Sm Area Small Dozer	600.00	CY	CODTA	46.88	2,140	231	0	0	2,370	3.95
Geotubes Material cost is for 45'Circumference Geotubes at 200' long. Other cost is for unloading and position into place and other misc costs associated with tube handling.	3.00	EA		0.00	0	0	78	600	678	226.00

Geotube Levee	3.00 EA			2,140	231	78	600	3,048	1016.16

Offshore Revetment (Group of 5)

EXCAVATION

HYD EXCAV, CRWLR, 2.50 CY BKT	9.54 HR	H25BA004	1.00	0	679	0	0	679	71.16
Outside Equip. Op. Medium	9.54 HR	X-EQOPRMED	1.00	193	0	0	0	193	20.25
WORK FLOAT, MED DUTY, 30'X10'X3'	9.54 HR	M10MZ003	1.00	0	16	0	0	16	1.71
Outside Laborer	9.54 HR	X-LABORER	1.00	217	0	0	0	217	22.81

LABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

Hannibal Dam Tailwater Revet	QUANTY	UOM	CREW ID	OUTPUT	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT
TUG BOAT, 150 TO 400 HP	9.54	HR	XX0XX004	1.00	0	245	0	0	245	25.66
Outside Equip. Op. Medium	9.54	HR	X-EQOPRMED	1.00	193	0	0	0	193	20.25
TUG BOAT, 500 TO 800 HP	9.54	HR	XX0XX002	1.00	0	607	0	0	607	63.68
Outside Equip. Op. Medium	9.54	HR	X-EQOPRMED	1.00	193	0	0	0	193	20.25
WORK BARGE-S,MED DUTY,60'X16'X5'	76.29	HR	M10MZ009	1.00	0	406	0	0	406	5.32
Outside Laborer	9.54	HR	X-LABORER	1.00	222	0	0	0	222	23.31
Outside Laborer	9.54	HR	X-LABORER	1.00	217	0	0	0	217	22.81
EXCAVATION	1335.00	CY			1,237	1,953	0	0	3,190	2.39
ROCK										
HYD EXCAV, CRWLR, 2.50 CY BKT	26.04	HR	H25BA004	1.00	0	1,853	0	0	1,853	71.16
Outside Equip. Op. Medium	26.04	HR	X-EQOPRMED	1.00	527	0	0	0	527	20.25
WORK FLOAT, MED DUTY, 30'X10'X3'	26.04	HR	M10MZ003	1.00	0	45	0	0	45	1.71
Outside Laborer	26.04	HR	X-LABORER	1.00	594	0	0	0	594	22.81
TUG BOAT, 150 TO 400 HP	26.04	HR	XX0XX004	1.00	0	668	0	0	668	25.66
Outside Equip. Op. Medium	26.04	HR	X-EQOPRMED	1.00	527	0	0	0	527	20.25
TUG BOAT, 500 TO 800 HP	26.04	HR	XX0XX002	1.00	0	1,658	0	0	1,658	63.68
Outside Equip. Op. Medium	26.04	HR	X-EQOPRMED	1.00	527	0	0	0	527	20.25
WORK BARGE-S,MED DUTY,60'X16'X5'	208.29	HR	M10MZ009	1.00	0	1,109	0	0	1,109	5.32
Outside Laborer	26.04	HR	X-LABORER	1.00	607	0	0	0	607	23.31
Outside Laborer	26.04	HR	X-LABORER	1.00	594	0	0	0	594	22.81
Rip Rap, 10# to 200# Pieces Random, Dumped from Truck onto barge to be shipped to site.	3645.00	CY	COETF	32.00	41,487	5,917	88,865	0	136,270	37.39
ROCK	3645.00	CY			44,864	11,250	88,865	0	144,979	39.77
Offshore Revetment (Group o	1.00	EA			46,100	13,203	88,865	0	148,168	148168
Habitat & Feeding Facilitie					68,584	33,044	88,943	20,600	211,171	
Planning, Engineering & Des					0	0	0	31,000	31,000	

Engineering During Construc	0	0	0	2,500	2,500
Construction Management	0	0	0	16,000	16,000
Hannibal Dam Tailwater Reve	68,584	33,044	88,943	98,925	289,496
West Virginia	68,584	33,044	88,943	98,925	289,496
Hannibal Dam	68,584	33,044	88,943	98,925	289,496

LABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

			QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT
06	West Virginia							
06-03	Hannibal Dam Tailwater Revetment							
06-03{	0100	Lands and Damages			28,825	0	28,825	
06-03{	0603	Fish & Wildlife Facilities and			263,585	65,896	329,481	
06-03{	3000	Planning, Engineering & Design			33,500	6,700	40,200	
06-03{	3100	Construction Management			16,000	3,200	19,200	
	TOTAL	Hannibal Dam Tailwater Revetment			341,910	75,796	417,706	
	TOTAL	West Virginia			341,910	75,796	417,706	
	TOTAL	Hannibal Dam			341,910	75,796	417,706	

LABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

	QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT
06 West Virginia						
06-03 Hannibal Dam Tailwater Revetment						
06-03{ 0100 Lands and Damages						
06-03{ 010001 Lands and Damages			28,825	0	28,825	
TOTAL Lands and Damages			28,825	0	28,825	
06-03{ 0603 Fish & Wildlife Facilities and						
06-03{ 060373 Habitat & Feeding Facilities						
06-03{ 060373}1 Mobilization			43,969	10,992	54,962	
06-03{ 060373}2 Dredging	13140	CY	30,866	7,716	38,582	2.94
06-03{ 060373}3 Geotube Levee	3.00	EA	3,805	951	4,756	1585.47
06-03{ 060373}4 Offshore Revetment (Group of 5)	1.00	EA	184,945	46,236	231,181	231181
TOTAL Habitat & Feeding Facilities			263,585	65,896	329,481	
TOTAL Fish & Wildlife Facilities and			263,585	65,896	329,481	
06-03{ 3000 Planning, Engineering & Design						
06-03{ 300001 Planning, Engineering & Design			31,000	6,200	37,200	
06-03{ 300002 Engineering During Construction			2,500	500	3,000	
TOTAL Planning, Engineering & Design			33,500	6,700	40,200	
06-03{ 3100 Construction Management						
06-03{ 310001 Construction Management			16,000	3,200	19,200	
TOTAL Construction Management			16,000	3,200	19,200	

TOTAL Hannibal Dam Tailwater Revetment	341,910	75,796	417,706
TOTAL West Virginia	341,910	75,796	417,706
TOTAL Hannibal Dam	341,910	75,796	417,706

LABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

No errors detected...

* * * END OF ERROR REPORT * * *

LABOR ID: FTCAMP EQUIP ID: NAT97A Currency in DOLLARS CREW ID: NAT99A UPB ID: UP99EA

SUMMARY REPORTS SUMMARY PAGE

DETAILED ESTIMATE DETAIL PAGE

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

July 2000

PRELIMINARY FINAL REPORT

INCREMENTAL ANALYSIS OF THE HANNIBAL DAM TAILWATER REVETMENTS PROJECT, WEST VIRGINIA

Submitted to

U.S. Army Corps of Engineer
Louisville District
Louisville, Kentucky

Submitted by

Federal Programs Division
Baton Rouge, Louisiana

July 2000

PRELIMINARY FINAL REPORT

Contract No. DACW27-99-D-0019
Delivery Order No. 0004
GEC Project No. 22321304

INCREMENTAL ANALYSIS OF THE HANNIBAL DAM TAILWATER REVETMENTS PROJECT, WEST VIRGINIA

Submitted to

U.S. Army Corps of Engineers
Louisville District
Louisville, Kentucky

Submitted by

G.E.C., Inc.
Baton Rouge, Louisiana

Engineering ? Economics ? Transportation Technology ? Social Analysis ? Environmental Planning

P.O. Box 84010 ? Baton Rouge, Louisiana 70884-4010 ? (225) 612-3000 ? Fax (225) 612-3016
9357 Interline Avenue ? Baton Rouge, Louisiana 70809-1910

TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION, PURPOSE AND NEED

This work presents an incremental analysis of the costs and benefits of the Ohio River ecosystem restoration project WV40 – Hannibal Dam Tailwater Revetments, a feasibility level study associated with a proposed ecosystem restoration program for the Ohio River. This study serves as an example incremental analysis for various ecosystem components considered as part of the program. The Corps has been involved in a large ecosystem restoration study of the Ohio River extending from Cairo, Illinois, to Pittsburgh, Pennsylvania. The Louisville, Huntington, and Pittsburgh districts are currently working with other Federal agencies and six states to develop an array of ecosystem restoration projects.

The proposed Hannibal Dam Tailwater Revetments project is located in Wetzel County, West Virginia, within the City of New Martinsville. The project site is immediately downstream (south) from the Hannibal Locks and Dam in the Ohio River Willow Island Pool between Ohio River Mile (ORM) 126.9 and 128.5 and is within the jurisdiction of the Huntington District, U.S. Army Corps of Engineers (USACE).

The primary goals of the Hannibal Dam Tailwater Revetments project are to provide aquatic habitat diversity downstream from Hannibal Dam, to provide winter velocity shelters for fishes in the Ohio River, and to provide off-shore structures for recreational fishing. Altering the heterogeneous habitat downstream from the dam would improve species diversity, facilitate a sustained fishery resource, and improve the recreational fishery in the area. The principal elements of the Hannibal Dam Tailwater Revetments project are the dredging of the mouth of a stream entering the Ohio River and the creation of various sized off-shore revetment structures.

Three proposed alternatives, presented below, were designed to meet the principal goals of the project.

2.0 PROPOSED ALTERNATIVES

2.1 No-Action

Under the No-Action Alternative, the aquatic habitat diversity presently downstream of Hannibal Dam would remain unchanged. The coarse sand/gravel substrate would continue to provide a habitat of limited complexity for fishes and benthic organisms. The lack of habitat diversity at this site would limit the diversity of fishes and other aquatic organisms occurring within the vicinity of recreational facilities just downstream of the dam. The mouth of Williams Run would remain at its present status, filled with silt, coarse sand, and gravel.

2.2 Alternative 1. Dredge Williams Run

Under this alternative, the mouth of Williams Run, a stream entering the Ohio River, will be dredged to provide a deepwater outlet for the City of New Martinsville stormwater system and enhance bank fishing opportunities. The mouth of Williams Run has become completely filled with silt, coarse sand, and gravel.

An estimated 13,140 cubic yards of silty-clay and sand material would be dredged to restore depths of 8 feet in the embayment mouth. Bottom side slopes will be reshaped to a 3:1. A small auger head dredge would be used, and the material would be pumped directly to the disposal site adjacent to the embayment. A small geotube levee 190 feet in length would be constructed at the designated disposal site for dewatering. Dewatered spoil material will be graded, reseeded with a mixture of cool season grasses, and maintained as part of the park.

2.3 Alternative 2. Construct 200'x20' Off-Shore Revetments

Under this alternative, five boulder (rip-rap) revetments would be constructed in-stream, parallel to the Ohio bank of the Ohio River. The off-shore revetments are rock structures designed to provide velocity shelters for aquatic animals, especially fishes. The Ohio River channel downstream from the Hannibal Dam has very little habitat diversity, primarily due to the high velocities associated with a tailwater area. Since this area is below the dam, river currents limit the natural deposition of structures such as snags. There is minimal bottom structure and habitat diversity in the location where the off-shore revetments would be positioned. The banks are characterized by gravel and rip-rap and the bottom substrates are composed primarily of small gravel and coarse sand. The creation of the proposed off-shore revetments would provide a complex structure with a more diversified submerged habitat. In addition to the added hard substrate, the altered bathymetry associated with changes in water flow would also enhance habitat diversity.

Two of the revetments would be placed parallel/adjacent to the east bank of the Ohio River from the handicap fishing pier downstream approximately 600 feet. Three additional off-shore revetments would be placed near the restricted access buoy line. Each of the structures will be parallel to the main channel and will be 200 feet long and 20 feet wide at the base of the structure. The side slopes would be 1.5 to 1, and the structure would be toed into the sub-grade a minimum of two feet. The size of the rock used will be uniformly graded limestone, with each rock weighing between 50 and 150 pounds. All rip-rap material would be shipped by barge to the project site. All costs for shipping are included in the material costs. The proposed structures are anticipated to function as designed. To ensure that navigation impacts do not occur, these structures will be evaluated by numerical analysis or physical model testing during the preconstruction, engineering, and design (PED) phase of the project.

The revetments will be constructed at various depths and at various distances from the shoreline to maximize habitat heterogeneity. The off-shore revetments will provide habitat diversity, winter velocity shelters for fishes, and hard structure for bank and boat fishermen.

2.4 Alternative 3. Construct 300'x25' Off-Shore Revetments

This alternative is similar to Alternative 2, except that the five revetments will measure 300 feet in length and 25 feet in width at the base of the structure. Five boulder revetments would be constructed in-stream, parallel to the Ohio bank of the Ohio River. Two of these structures would be placed parallel/adjacent to the east bank of the Ohio River from the handicap fishing pier downstream approximately 600 feet. Three additional off-shore revetments would be placed near the restricted access buoy line. Each of the structures will be parallel to the main channel and will be 300 feet long and 25 feet wide at the base of the structure. The side slopes would be 1.5 to 1, and the structure would be toed into the sub-grade a minimum of two feet. The size of the rock used will be

uniformly graded limestone, with each rock weighing between 50 and 150 pounds. The proposed structures are anticipated to function as designed. To ensure that navigation impacts do not occur, these structures will be evaluated by numerical analysis or physical model testing during the preconstruction, engineering, and design (PED) phase of the project.

The revetments will be constructed at various depths and at various distances from the shoreline to maximize habitat heterogeneity. The creation of the proposed off-shore revetments would provide a more complex submerged habitat. In addition to the added hard substrate, the altered water flow would also enhance habitat diversity, winter velocity shelters for fishes, and hard structure for bank and boat fishermen.

3.0 COST ANALYSIS

3.1 Introduction

This section presents the findings of a cost effectiveness and incremental cost analysis of No-Action, the three alternatives, and various combinations of the alternatives under consideration. These cost analyses are not intended to determine the best alternative or combination of alternatives, but rather are intended to provide decision-makers with a comparison of alternatives that produce different levels of environmental outputs and to assist in selecting the alternative that best satisfies project objectives. The analyses are intended to improve the quality of decision-making when considering alternative plans.

The cost effectiveness and incremental cost analysis was conducted in accordance with guidelines contained in EC 1105-2-206, entitled *Project Modification for Improvement of the Environment*, which is the same guidance as EC 1105-2-210, dated June 1, 1995, entitled *Ecosystem Restoration in the Civil Works Program;* EC 1105-2-214, dated October 3, 1998, entitled *Project Modifications for Improvement and Aquatic Ecosystem Restoration;* and Institute for Water Resources report *Evaluation of Environmental Investments Procedures Manual Interim: Cost Effectiveness and Incremental Cost Analyses*, dated May 1995 (IWR Report 95-R-1).

The Institute for Water Resources (IWR) has developed IWR-PLAN Decision Support Software to assist with the formulation and comparison of alternative plans of environmental restoration projects. IWR-PLAN assists in plan formulation by combining solutions to planning problems and calculating the additive effects of each alternative or combination of alternatives. When developing a combination of alternatives, IWR-PLAN includes each alternative in the combination, assigning either an action or no-action status to each. For instance, when evaluating a project with three alternatives, IWR-PLAN calculates total environmental output for implementing Alternative 1 as the output associated with implementing Alternative 1 plus the output (if any) associated with no-action under alternatives 2 and 3.

IWR-PLAN assists in plan formulation and comparison of alternatives by conducting cost effectiveness and incremental cost analyses. IWR-PLAN was used in conducting the cost effectiveness and incremental cost analyses for the Hannibal Dam Tailwater Revetments Project.

As the name indicates, cost effectiveness analysis is a method for comparing alternative plans that produce environmental outputs and determining which plan can produce the largest quantity of

output for a given cost or produce the same or greater quantity of output for less cost. Cost effectiveness analysis determines if: (1) the same environmental output level could be produced by another plan at less cost; (2) a larger environmental output level could be produced at the same cost; or (3) a larger environmental output level could be produced at less cost. For instance, if two alternatives produce the same amount of environmental outputs, the alternative with the lowest cost is considered cost effective. Likewise, if the costs of two alternatives are equal, but one produces more outputs than the other, the one producing the higher level of outputs would be the cost effective alternative. Also, an alternative that costs less and produces higher levels of output is considered to be cost effective compared to higher cost alternatives producing lower levels of output.

Incremental cost analysis builds on the findings of the cost effectiveness analysis. This is accomplished by comparing the increase in costs to the increase in outputs that are associated with advancing from one output level (one cost effective alternative) to the next higher output level (another cost effective alternative).

3.2 Cost Estimates of Alternatives

To conduct cost effectiveness and incremental cost analyses, the total cost of implementing each alternative must be estimated and stated on an average annual basis. Preliminary cost estimates for alternatives presented in the feasibility report were obtained from the Microcomputer Aided Cost Estimating System (MCACES) cost estimates developed as part of the feasibility report and additional cost elements (real estate, plans and specifications, and supervision and administration during construction). Cost estimates for alternatives developed as part of this analysis were based on MCACES per-unit costs presented in the feasibility report and calculated quantities.

3.2.1. Alternative 1. Dredge Williams Run. The total estimated cost associated with implementing Alternative 1 is $69,876 (Table 3-1). Activities included in these costs are equipment mobilization, dredging approximately 13,140 cubic yards of material at the mouth of Williams Run, and construction of a geotube levee around the disposal site. Also included in the costs are contingencies, real estate costs, plans and specifications, supervision and administration during construction, and interest during construction. Interest during construction is based on the federal discount rate of 6.625 percent and a construction schedule of 33 days.

3.2.2 Alternative 2. Construct 200'x20' Off-Shore Revetments. The total estimated cost of Alternative 2 is $231,187 (Table 3-2). Activities included in these costs are equipment mobilization, riverbed evacuation, and placement of the rock revetments. Also included in the costs are contingencies, real estate costs, plans and specifications, supervision and administration during construction, and interest during construction. Interest during construction is based on the federal discount rate of 6.625 percent and a construction schedule of 42 days.

Table 3-1. Hannibal Dam Tailwater Revetments Project, Alternative 1, Dredge Williams Run, Cost Estimate

Item	Costs
Dredging Costs	
Mobilization	$15,226
Dredging	$24,726
Geotube Levee	$3,048
Contingencies	$3,010
Real Estate Costs	$12,825
Plans and Specifications	$6,515
S & A During Construction	$4,316
Cost Subtotal	$69,667
Interest During Construction	$209
Gross Investment	$69,876

Sources: Ohio River Mainstream Ecosystem Restoration Project – Feasibility Report; Louisville District, USACE; and G.E.C., Inc.

Table 3-2. Hannibal Dam Tailwater Revetments Project, Alternative 2, Construct 200'x20' Off-Shore Revetments, Cost Estimate

Item	Costs
Off-Shore Revetment Costs	
Mobilization	$20,000
Excavation	$3,190
Rock	$144,979
Contingencies	$11,772
Real Estate Costs	$8,000
Plans and Specifications	$25,485
S & A During Construction	$16,884
Cost Subtotal	$230,309
Interest During Construction	$878
Gross Investment	$231,187

Sources: Ohio River Mainstream Ecosystem Restoration Project – Feasibility Report; Louisville District, USACE; and G.E.C., Inc.

3.2.3 Alternative 3. Construct 300'x25' Off-Shore Revetments. The total estimated cost of implementing Alternative 3 is $396,839 (Table 3-3). Activities included in these costs are equipment mobilization, riverbed excavation, and placement of rock revetments. Other included costs are contingencies, real estate costs, plans and specifications, supervision and administration during construction, and interest during construction. Interest during construction is based on the federal discount rate of 6.625 percent and a construction schedule of 79 days.

Table 3-3. Hannibal Dam Tailwater Revetments Project, Alternative 3, Construct 300'x25' Off-Shore Revetments, Cost Estimate

Item	Costs
Off-Shore Revetment Costs	
Mobilization	$20,000
Excavation	$6,106
Rock	$294,934
Contingencies	$22,473
Real Estate Costs	$8,000
Plans and Specifications	$25,500
S & A During Construction	$17,000
Cost Subtotal	$394,014
Interest During Construction	$2,825
Gross Investment	$396,839

Sources. Ohio River Mainstream Ecosystem Restoration Project – Feasibility Report; Louisville District, USACE; and G.E.C., Inc.

3.3 Average Annual Cost

Table 3-4 presents a summary of the cost estimates for the three alternatives. The average annual cost of implementing each alternative, assuming a 50-year project life and a federal discount rate of 6.625 percent, is also presented. The average annual cost is the annual amount required to amortize the present value of project costs over the life of the project. It is equivalent to the annual payment needed to finance the project over 50 years at 6.625 percent interest.

Table 3-4. Hannibal Dam Tailwater Revetments Project, Summary of Construction and O & M Costs for Each Alternative

Item	Alternative 1	Alternative 2	Alternative 3
Gross Investment	$69,876	$231,187	$396,839
Annualized Gross Investment Cost	$4,824	$15,962	$27,399
Annualized O&M Costs	$14,594	$5,458	$11,101
Total Annualized Costs	$19,418	$21,420	$38,500

Sources: Ohio River Mainstream Ecosystem Restoration Project - Feasibility Report; Louisville District, USACE; and G.E.C., Inc.

The average annual cost of Alternative 1, Dredge Williams Run, is $19,418. This includes an average annual cost of gross investment of $4,824 and average annual operation and maintenance costs of $14,594. The operation and maintenance costs are based on costs of $83,300 expected to be incurred every 5 years during the life of the project. These costs are discounted to their net present value, then amortized over the life of the project.

The average annual cost of Alternative 2, Construct 200'x20' Off-Shore Revetments, is $21,420. This includes an average annual cost of gross investment of $15,962 and average annual operation and maintenance costs of $5,458. The operation and maintenance costs are based on costs of $74,084 expected to be incurred every 10 years during the life of the project. These costs are discounted to their net present value, then amortized over the life of the project.

The average annual cost of Alternative 3, Construct 300'x25' Off-Shore Revetments, is $38,500. This includes an average annual cost of gross investment of $27,399 and average annual operation and maintenance costs of $11,101. The operation and maintenance costs are based on costs of $150,700 expected to be incurred every 10 years during the life of the project. These costs are discounted to their net present value, then amortized over the life of the project.

3.4 Environmental Benefits

Environmental impacts associated with no-action and each alternative were measured in habitat acres. Because of resource and time constraints, field surveys could not be conducted to define the impact of each alternative. Therefore, environmental impacts were estimated using information provided in the feasibility report. Extensive field surveys would be required to more accurately quantify the environmental impacts of each alternative.

3.4.1. Alternative 1. Dredge Williams Run.

The mouth of Williams Run has become filled with silt, coarse sand, and gravel. The proposed action is to dredge the mouth of the creek to a depth of eight feet, which would provide a deepwater outlet for the City of New Martinsville stormwater system. This action would improve bank-fishing opportunities for anglers and enhance habitat diversity downstream of the dam by creating approximately one acre of deepwater habitat.

3.4.2. Alternative 2. Construct 200'x20' Off-Shore Revetments.

The riverbed below the Hannibal Dam has very little submerged structure available to aquatic organisms due to the high velocities associated with the tailwaters of the dam. The proposed project calls for the construction of two revetments along the left-descending bank of the river and three additional revetments within the river channel near the restricted access buoy line and parallel to the river channel. These structures would enhance habitat diversity in the vicinity of the structures by adding a hard substrate and altering the water flow patterns in the river. The structures would provide approximately 0.5 acre of submerged hard substrate that would be used as velocity shelters and escape cover for a variety of fishes and invertebrates. Estimates of habitat acres created by the rock revetments are based on the total amount of surface area of all of the revetments. The enhancement of habitat diversity cannot be quantified without a more detailed analysis. By adding

complexity to the aquatic habitat, these structures would also enhance the recreational fishery within the area.

3.4.3 Alternative 3. Construct 300'x25' Off-Shore Revetments.

This alternative proposes the same type of action as Alternative 2 except with large revetments. Each of the revetments will be 25 feet wide and 300 feet long. These larger revetments will provide approximately 0.19 acre per revetment compared to 0.1 acre per revetment under Alternative 2. The total submerged hard substrate provided by this alternative is approximately 0.95 acre. Estimates of habitat acres created by the rock revetments are based on the total amount of surface area of all of the revetments. The placement of these structures would also improve habitat diversity through adding hard substrates and altering water flows in the areas surrounding the structures. However, this habitat cannot be quantified without a detailed analysis of the site.

3.4.4 Summary of Environmental Benefits

Alternative 1, Dredge Williams Run, results in an average annual increase of 1.0 acre of habitat. Implementing Alternative 2, Construct 200'x20' Off-Shore Revetments, results in an average annual increase of 0.5 acre of habitat. Implementing Alternative 3, Construct 300'x25' Off-Shore Revetments, results in an average annual increase of 0.95 acre of habitat. No-Action for all three alternatives results in no significant environmental impacts.

3.5 Relationship Among Alternatives

Alternative 1 can be effectively combined with Alternative 2 or Alternative 3. However, alternatives 2 and 3 cannot be combined with each other. Alternatives 2 and 3 are variations of the size of rock revetments to be placed in the Ohio River; therefore, only one of these alternatives can be implemented. The costs and environmental outputs of the alternatives that can be combined are additive. IWR-PLAN requires that each alternative be assigned costs and outputs associated with both implementing and not implementing the alternative. The cost for not implementing an alternative (No-Action) is $0. The environmental outputs associated with not implementing an alternative (No-Action) are the quantity of habitat that would be impacted (lost) over the life of the project if the alternative is not implemented. These values are calculated in terms of average annual impacts, which are the cumulative number of acres impacted each year by the project divided by 50, the number of years the project will exist. The No-Action outputs are entered into IWR-PLAN as negative values (lost habitat).

The cost of implementing each alternative is stated in average annual costs and includes construction costs and operation and maintenance costs. The environmental outputs associated with implementing each alternative are calculated as the quantity of habitat created by the alternative and the quantity of habitat protected from loss if the alternative were not implemented (the No-Action impacts). Because of the method that IWR-PLAN uses to combine alternatives to derive the various combinations of alternatives, the impacts associated with implementing the alternative must be entered into the program as net impacts. Net impacts for each alternative are calculated as the impacts associated with implementing the alternative minus the No-Action impacts.

When developing the combination of alternatives, IWR-PLAN includes each alternative in the combination and assigns either an action or No-Action status to each. For instance, the IWR-PLAN derived output from implementing the combination of alternatives 1 and 3 is actually calculated as the combination of the net impacts of the action of Alternative 1 (1.0 acre) and Alternative 3 (0.95 acre) and the no-action impact of Alternative 2 (0 acres), resulting in a combined impact of 1.95 acres.

Including No-Action, a total of six actual combinations of alternatives exist.

3.6 Cost Effectiveness Analysis

Cost effectiveness analysis is intended to illustrate which alternatives can produce the same amount of environmental output for less costs or a larger quantity of output for the same or less cost. Table 3-5 presents the average annual cost, annual environmental outputs, and average cost per output for each combination of alternatives. The cost-effective combinations are: No-Action; Alternative 1; and the combinations of alternatives 1 and 2 and alternatives 1 and 3. These combinations are presented in bold type in Table 3-5.

Table 3-5. Hannibal Dam Tailwater Revetments Project, Cost Effectiveness Analysis

Alternative	Outputs (Acres)	Costs ($1,000)	Average Cost ($/Acres)
No Action	**0.00**	**0.00**	**0**
Alternative 1	**1.00**	**19.42**	**19,420**
Alternative 2	0.50	21.42	42,840
Alternative 3	0.95	38.50	40,526
Alternatives 1 and 2	**1.50**	**40.84**	**27,227**
Alternatives 1 and 3	**1.95**	**57.92**	**29,703**

Source: G.E.C., Inc.

3.7 Incremental Cost Analysis

Incremental cost analysis illustrates the increase in costs associated with advancing from one output level to the next higher output level. Table 3-6 presents the average annual cost, the annual environmental output, the average cost of output, the incremental output, and the total and per unit incremental cost of the "best buy" alternatives.

Alternative 1 and the combination of alternative 1 and 3 are considered "best buy" alternatives, or the alternatives that would generate the most output for any additional money expended. The average cost per habitat acre for Alternative 1 is $19,420, which is also the incremental cost per acre. A total of 1.0 beneficial habitat acre is produced under this alternative. The total annual incremental cost, the increase in costs from No-Action, is $19,420.

Table 3-6. Hannibal Dam Tailwater Revetments Project, Incremental Cost Analysis of Increasing Output from the No-Action Alternative for the "Best Buy" Alternatives

Alternative	Outputs (Acres)	Costs ($1,000)	Average Cost ($/Acres)	Incremental Cost ($1,000)	Incremental Output (Acres)	Incremental Cost Per Output ($)
Alternative 1	1.0	19.42	19,420	19.42	1.0	19,420
Alternatives 1 and 3	1.95	57.92	29,703	38.50	0.95	40,526

Source: G.E.C., Inc.

The combination of alternatives 1 and 3 produces 1.95 beneficial habitat acres at an annual average cost of $29,703, resulting in an average cost of $57,920 per habitat acre. When compared to Alternative 1, the annual incremental cost of this combination is $38,500, and the incremental output is 0.95 beneficial habitat acres, yielding a per unit incremental cost of $40,526.

Alternative 1 generates 1.0 acre of habitat at a cost of $19,420. In order to generate more than 1.0 acre of habitat, the cost-effective combinations of alternatives 1 and 2 or alternatives 1 and 3 must be implemented. The combination of alternatives 1 and 2 produces a total of 1.5 acres, or 0.5 acres more than Alternative 1, at a total cost of $40,840, or $21,420 more than Alternative 1. This equates to a cost of $42,840 ($21,420/0.5) per additional acre of output over the 1.0 acre produced under Alternative 1. The combination of alternatives 1 and 3 produces a total of 1.95 acres, or 0.95 acres more than Alternative 1, at a total cost of $57,920, or $38,500 more than Alternative 1. This equates to a cost of $40,526 ($38,500/0.95) per additional acre of output over the 1.0 acre produced under Alternative 1. Therefore, if decision-makers desire to produce more than the 1.0 acre generated under Alternative 1, the combination of alternatives 1 and 3 produces more output at a lower per unit cost, making it a "better buy" than the combination of alternatives 1 and 2. For this reason, Alternative 1 and the combination of alternatives 1 and 3 are considered "best buy" plans.

4.0 SUMMARY AND CONCLUSION

This report presents an incremental analysis of the Hannibal Dam Tailwater Revetments Project, which is associated with a proposed ecosystem restoration program for the Ohio River. The Hannibal Dam Tailwater Revetments Project is in Wetzel County, within the City of New Martinsville, West Virginia, immediately downstream from the Hannibal Locks and Dam on the Ohio River. The primary goals of the Hannibal Dam Tailwater Revetments project are to provide aquatic habitat diversity downstream from Hannibal Dam, to provide winter velocity shelters for fishes in the Ohio River, and to provide off-shore structures for recreational fishing. The principal elements of the Hannibal Dam Tailwater Revetments project are the dredging of the mouth of a stream entering the Ohio River and the creation of various sized off-shore revetment structures. Three alternatives were evaluated as part of the project and include: Alternative 1, Dredge Williams Run; Alternative 2, Construct 200'x20' Off-Shore Revetments; and Alternative 3, Construct 300'x25' Off-Shore Revetments.

Under Alternative 1, Dredge Williams Run, the mouth of Williams Run will be dredged to a depth of eight feet. This alternative will provide a deepwater outlet for the City of New Martinsville

stormwater system and enhance bank fishing. Under Alternative 2, Construct 200'x20' Off-Shore Revetments, five boulder revetments approximately 200 feet in length will be constructed at various depths and distances from the shoreline. These revetments are intended to provide habitat diversity, winter velocity shelters for fish, and hard structure for bank and boat fishermen. Under Alternative 3, Construct 300'x25' Off-Shore Revetments, five boulder revetments approximately 300 feet in length and 25 feet in width would be constructed at various depths and distances from the shoreline. These revetments are intended to provide habitat diversity, winter velocity shelters for fish, and hard structure for bank and boat fishermen.

The following subsections provide a summary of impacts, as well as the cost effectiveness analysis.

4.1 Environmental Benefits

4.1.1. Alternative 1. Dredge Williams Run. Dredging the mouth of Williams Run will provide a deep water outlet for the City of New Martinsville stormwater system and enhance bank fishing. If this alternative is implemented, 1.0 acre of aquatic habitat will be created. There will be no direct loss of habitat for no-action under this alternative.

4.1.2. Alternative 2. Construct 200'x20' Off-Shore Revetments. Constructing five off-shore revetments in the Ohio River will provide habitat diversity, winter velocity shelters for fish, and hard structure for bank and boat fishermen. If this alternative is implemented, 0.5 acre of hard substrate aquatic habitat will be created. There will be no direct loss of habitat for no-action under this alternative.

4.1.3 Alternative 3. Construct 300'x25' Off-Shore Revetments. Constructing five large off-shore revetments in the Ohio River will provide habitat diversity, winter velocity shelters for fish, and hard structure for bank and boat fishermen. If this alternative is implemented, 0.95 acre of hard substrate aquatic habitat will be created. There will be no direct loss of habitat for no-action under this alternative.

4.2 Cost Effectiveness and Incremental Cost Analysis

Cost effectiveness and incremental cost analyses were conducted for the combination of alternatives in order to provide decision-makers with information to choose the combination of alternatives that best satisfy project objectives. The environmental output of the alternatives were measured in habitat acres. Cost effectiveness analysis compares alternative plans that produce environmental outputs and determines which plan produces the largest quantity of output for a given cost, or produce the same or greater quantity of output for less cost. The cost-effective alternatives and combination of alternatives are: No-Action; Alternative 1; and the combinations of alternatives 1 and 2 and alternatives 1 and 3.

Incremental cost analysis compares the increase in costs (of cost-effective alternatives) of advancing from one output level to the next higher level of output. The resulting "best buy" alternatives are Alternative 1 and the combination of alternatives 1 and 3. The average cost per habitat acre for Alternative 1 is $19,420, which is also the incremental cost per acre. A total of 1.0 beneficial habitat acre is produced under this combination. The total annual incremental cost, the increase in costs from No-Action, is $19,420. The combination of alternatives 1 and 3 produces 1.95 beneficial habitat

acres at an average cost of $29,703 per habitat acre. When compared to Alternative 1, the annual incremental cost of this combination is $38,500 and the incremental output is 0.95 beneficial habitat acre, yielding a per unit incremental cost of $40,526.